GROUP 13B

MULTIPORT FUEL INJECTION (MPI) <4G1>

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GENERAL INFORMATION

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The Multipoint Fuel Injection System consists of sensors which detect the engine conditions, the engine-ECU which controls the system based on signals from these sensors, and actuators which operate under the control of the engine-ECU. The engine-ECU carries out activities such as fuel injection control, idle speed control and ignition timing control. In addition, the engine-ECU is equipped with several diagnosis modes which simplify troubleshooting when a problem develops.

FUEL INJECTION CONTROL

The injector drive times and injection timing are controlled so that the optimum air/fuel mixture is supplied to the engine to correspond to the continually-changing engine operation conditions.
A single injector is mounted at the intake port of each cylinder. Fuel is sent under pressure from the fuel tank by the fuel pump, with the pressure being regulated by the fuel pressure regulator. The fuel thus regulated is distributed to each of the injectors.
Fuel injection is normally carried out once for each cylinder for every two rotations of the crankshaft. The firing order is 1-3-4-2. This is called sequential fuel injection. The engine-ECU provides a richer air/fuel mixture by carrying out "open-loop" control when the engine is cold or operating under high load conditions in order to maintain engine performance. In addition, when the engine is warm or operating under normal conditions, the engine-ECU controls the air/fuel mixture by using the oxygen sensor signal to carry out "closed-loop" control in order to obtain the theoretical air/fuel mixture ratio that provides the maximum cleaning performance from the three way catalyst.

THROTTLE VALVE OPENING CONTROL

This system electrically controls the opening of the throttle valve. The engine-ECU detects the amount of travel of the accelerator pedal via the accelerator pedal position sensor, and controls the actuation of the throttle valve control servo, which is mounted on the throttle body, in order to attain the target throttle valve opening that has been predetermined in accordance with driving conditions.

IDLE SPEED CONTROL

The idle speed is kept at the optimum speed by controlling the amount of air that passes through the throttle valve in accordance with changes in idling conditions and engine load during idling.

The engine-ECU drives the throttle valve control servo to keep the engine running at the pre-set idle target speed in accordance with the engine coolant temperature and A/C and other electrical load. In addition, when the air conditioning switch is turned off and on while the engine is idling, the throttle valve control servo adjusts the throttle valve passes through air amount according to the engine load conditions to avoid fluctuations in the engine speed.

IGNITION TIMING CONTROL

The power transistor located in the ignition primary circuit turns ON and OFF to control the primary current flow to the ignition coil. This controls the ignition timing in order to provide the optimum ignition timing with respect to the engine operating conditions. The ignition timing is determined by the engine-ECU from the engine speed, intake air volume, engine coolant temperature and atmospheric pressure.

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SELF-DIAGNOSIS FUNCTION

- When an abnormality is detected in one of the sensors or actuators related to emission control, the engine warning lamp (check engine lamp) illuminates as a warning to the driver.
- When an abnormality is detected in one of the sensors or actuators, a diagnosis code corresponding to the abnormality is output.
- The RAM data inside the engine-ECU that is related to the sensors and actuators can be read by means of the M.U.T.-III. In addition, the actuators can be force-driven under certain circumstances.

OTHER CONTROL FUNCTIONS

1. Fuel Pump Control

Turns the fuel pump relay ON so that current is supplied to the fuel pump while the engine is cranking or running.

2. A/C Relay Control

Turns the compressor clutch of the A/C ON and OFF.

3. Oil Control Valve Control

The engine-ECU carries out the duty control of the oil control valve according to the operation condition. This varies the phase angle of the intake camshaft to optimize the intake valve timing.

4. Fan Motor Control

The revolutions of the radiator fan and condenser fan are controlled in response to the engine coolant temperature and vehicle speed.

5. Alternator Output Current Control

Prevents alternator output current from increasing suddenly and idle speed from dropping at times such as when the headlamp are turned on.

6. Purge Control Solenoid Valve Control

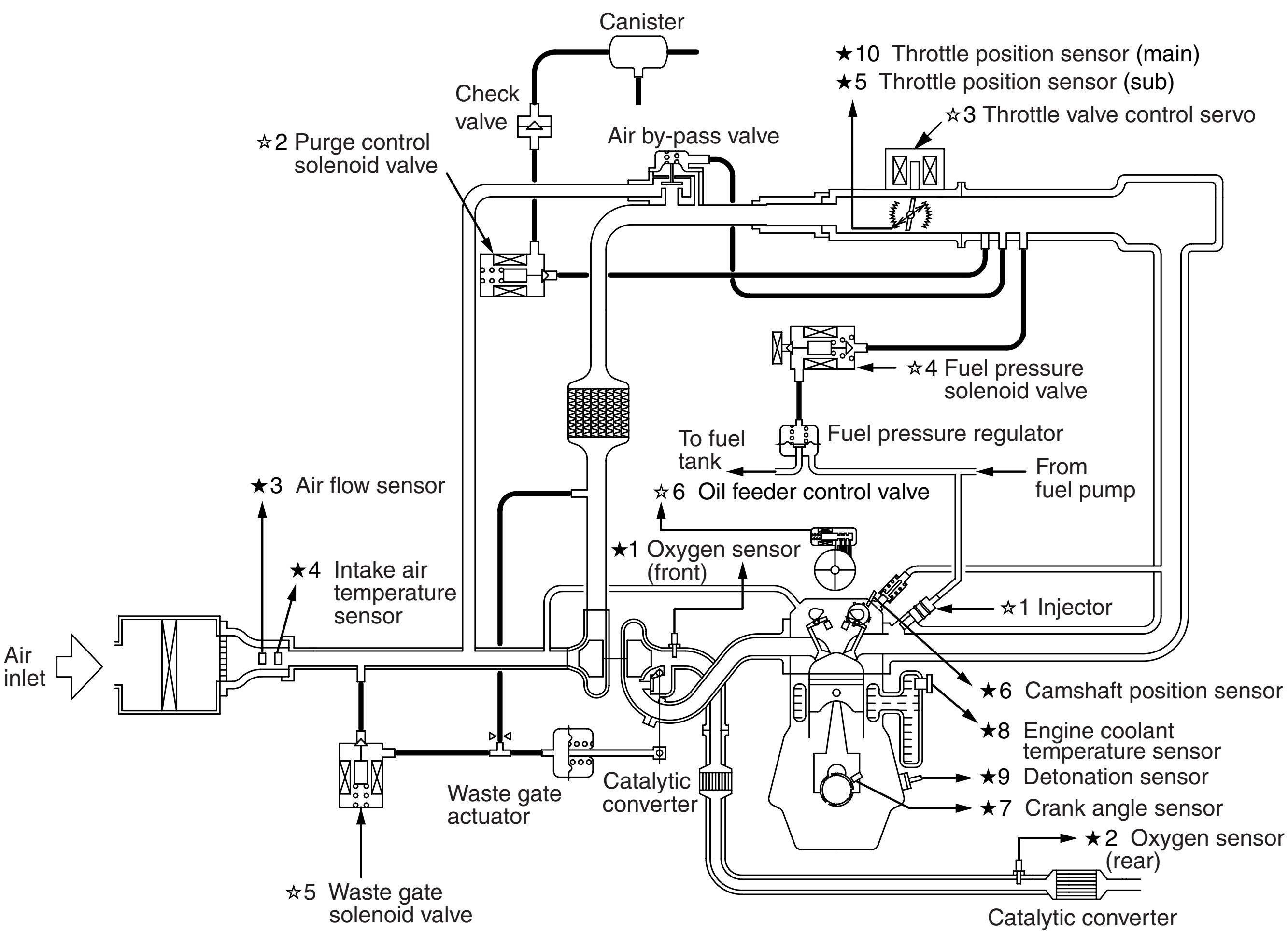
(Refer to P.17-13, GROUP 17 – Engine And Emission Control – Evaporative Emission Control System).

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GENERAL SPECIFICATIONS

Items		Specifications
Throttle body	Throttle bore mm	45
	Throttle position sensor	Hall element type
	Throttle valve control servo	DC motor type, having broshes
Engine-ECU	Identification No.	E6T45179
Sensors	Barometric pressure sensor	Semiconductor type
	Intake air temperature sensor	Thermistor type
	Engine coolant temperature sensor	Thermistor type
	Oxygen sensor	Zirconia type
	Accelerator pedal position sensor	Hall element type
	Camshaft position sensor	Magneto resistance element type
	Crank angle sensor	Magneto resistance element type
	Detonation sensor	Piezoelectric type
Actuators	Engine control relay type	Contact switch type
	Fuel pump relay type	Contact switch type
	Injector type and number	Electromagnetic type, 4
	Injector identification mark	HDB305E
	Throttle actuator control motor relay	Contact switch type
	Oil feeder control valve	Duty cycle type solenoid valve
	Purge control solenoid valve	Duty cycle type solenoid valve
	Fuel pressure solenoid valve	ON/OFF type solenoid valve
	Waste gate solenoid valve	Duty cycle type solenoid valve
Fuel pressure regulator	Regulator pressure kPa	294

Sensors	Switches and signals	⇨	Engine-ECU	⇨	Actuators	Relays and outputs
★ 1 Oxygen sensor (front) ★ 2 Oxygen sensor (rear) ★ 3 Air flow sensor ★ 4 Intake air temperature sensor ★ 5 Throttle position sensor (sub) ★ 6 Camshaft position sensor ★ 7 Crank angle sensor ★ 8 Engine coolant temperature sensor ★ 9 Detonation sensor ★10 Throttle position sensor (main)	● Power supply ● Ignition switch-IG ● Ignition switch-ST ● Accelerator pedal position sensor (main) ● Accelerator pedal position sensor (sub) ● Alternator FR terminal ● Stop lamp switch ● Clutch switch	⇨	Engine-ECU ●Barometric pressure sensor	⇨	☆ 1 Injector ☆ 2 Purge control solenoid valve ☆ 3 Throttle valve control servo ☆ 4 Fuel pressure solenoid valve ☆ 5 Waste gate solenoid valve ☆ 6 Oil feeder control valve	● Engine control relay ● Fuel pump relay ● A/C compressor relay ● Throttle valve control servo relay ● Ignition coil ● Cooling fan control relay (Hi, Lo) ● Diagnosis output ● Alternator G terminal ● Oxygen sensor (front) heater ● Oxygen sensor (rear) heater



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SERVICE SPECIFICATIONS

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Items		Specifications
Intake air temperature sensor resistance kΩ	–20°C	13 – 17
	0°C	5.7 – 6.7
	20°C	2.3 – 3.0
	40°C	1.0 – 1.5
	60°C	0.56 – 0.76
	80°C	0.30 – 0.42
Engine coolant temperature sensor resistance kΩ	–20°C	14 – 17
	0°C	5.1 – 6.5
	20°C	2.1 – 2.7
	40°C	0.9 – 1.3
	60°C	0.48 – 0.68
	80°C	0.26 – 0.36
Fuel pressure kPa	Vacuum hose connected	Approximately 230
	Vacuum hose disconnected	289 – 299
Injector coil resistance (at 20°C) Ω		10.5 – 13.5
Oxygen sensor output voltage V		0.6 – 1.0
Oxygen sensor heater resistance (at 20°C) Ω	Front	5 – 30
	Rear	5 – 30
Throttle valve control servo coil resistance (at 20°C) Ω		0.3 – 100
Oil feeder control valve resistance (at 20°C) Ω		6.9 – 7.9
Fuel pressure solenoid valve resistance (at 20°C) Ω		29 – 35

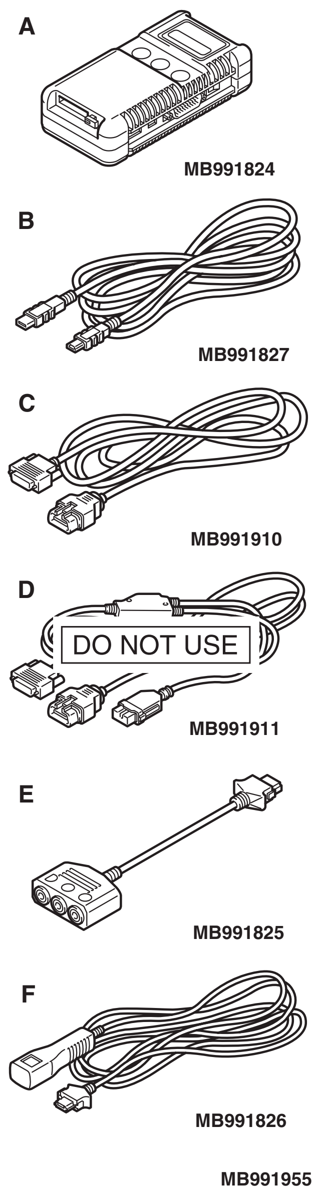
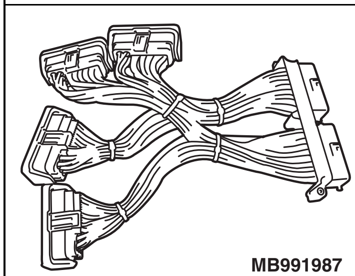
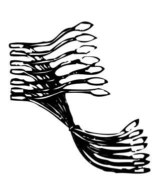
SEALANT

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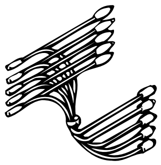
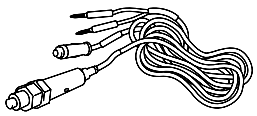
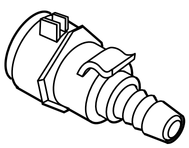
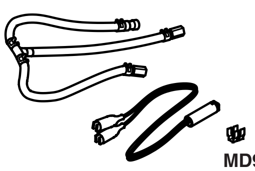
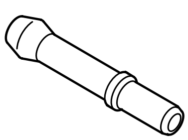
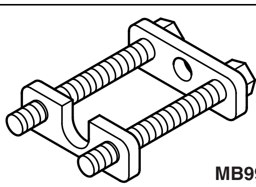
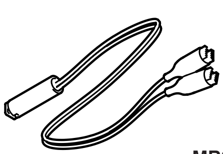
Item	Specified sealant	Remark
Engine coolant temperature sensor threaded portion	3M Nut Locking Part No. 4171 or equivalent	Drying sealant

SPECIAL TOOLS

M1131000601851

Tool	Number	Name	Use
	MB991955 A: MB991824 B: MB991827 C: MB991910 D: MB991911 E: MB991825 F: MB991826	M.U.T.-III sub assembly A: Vehicle communication interface (V.C.I.) B: M.U.T.-III USB cable C: M.U.T.-III main harness A (vehicles with CAN communications system) D: M.U.T.-III main harness B (vehicles without CAN communications system) E: M.U.T.-III measurement adapter F: M.U.T.-III trigger harness	• Reading diagnosis code • Inspection of MPI system • Measurement of fuel pressure ⚠ CAUTION **For vehicles with a CAN communication, use M.U.T.-III main harness A to send simulated vehicle speed. If you connect M.U.T.-III main harness B instead, the CAN communication does not function correctly.**
	MB991987	Power plant ECU check harness	• Measurement of voltage during troubleshooting • Measurement of engine-ECU terminal voltage • Inspection using an oscilloscope
	MB991709	Test Harness	• Measurement of voltage for troubleshooting • Inspection using an oscilloscope

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Tool	Number	Name	Use
 MB991658	MB991658	Test Harness	• Measurement of voltage during troubleshooting • Inspection using an oscilloscope • Inspection of oxygen sensor
 MB991637	MB991637	Fuel pressure gauge set	Measurement of fuel pressure
 MB991981	MB991981	Fuel pressure gauge set	
 MB991990	MB991990	Quick connector	
 MD998706	MD998706	Injector test set	• Checking the spray condition of injectors • Measurement of fuel pressure
 MB992001	MD992001	Hose adapter	
 MB991976	MB991976	Injector holder	Checking the spray condition of injectors
 MB991607	MB991607	Injector test harness	

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TROUBLESHOOTING

DIAGNOSIS TROUBLESHOOTING FLOW

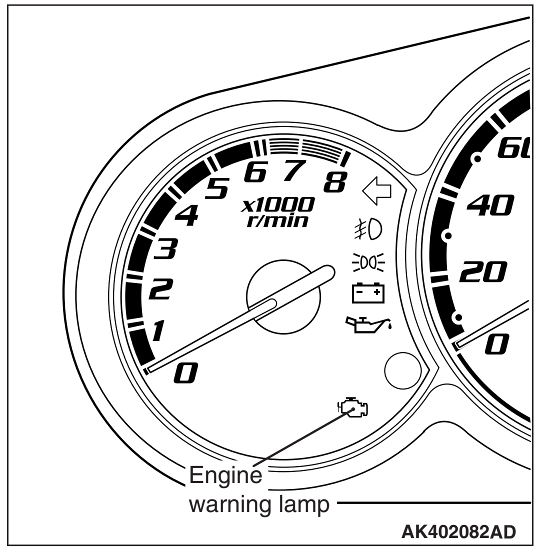
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Refer to P.00-5, GROUP 00 – How to Use Trouble-shooting/Inspection Service Points – How to Cope with Intermittent Malfunctions.

DIAGNOSIS FUNCTION

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ENGINE WARNING LAMP (CHECK ENGINE LAMP)



The engine warning lamp illuminates in the event of an abnormality in any of the diagnosis items related to the Multipoint Fuel Injection (MPI) system listed below. Check diagnosis code outputs both when the lamp stays illuminated and when it lights up or flashes while the engine is running. Even when there is no problem, the lamp is caused to illuminate for about 5 seconds after turning the ignition switch to the ON position for the blown bulb checking purposes.

ENGINE WARNING LAMP INSPECTION ITEMS

Code No.	Diagnosis item
P0090	Fuel pressure solenoid valve system
P0100	Airflow sensor system
P0105	Barometric pressure sensor system
P0110	Intake air temperature sensor system
P0115	Engine coolant temperature sensor system
P0122	Throttle position sensor (main) circuit low input
P0123	Throttle position sensor (main) circuit high input
P0125	Feedback system monitor
P0130	Oxygen sensor (front) system
P0135	Oxygen sensor (front) heater system
P0136	Oxygen sensor (rear) system
P0141	Oxygen sensor heater (rear) system
P0170	Abnormal fuel system
P0201	No. 1 injector system

Code No.	Diagnosis item
P0202	No. 2 injector system
P0203	No. 3 injector system
P0204	No. 4 injector system
P0222	Throttle position sensor (sub) circuit low input
P0223	Throttle position sensor (sub) circuit high input
P0243	Waste gate solenoid valve system
P0300	Random/multiple cylinder misfire detected
P0301	No. 1 cylinder misfire detected
P0302	No. 2 cylinder misfire detected
P0303	No. 3 cylinder misfire detected
P0304	No. 4 cylinder misfire detected
P0325	Detonation sensor system
P0335	Crank angle sensor system
P0340	Camshaft position sensor system
P0421	Warm up catalyst malfunction
P0443	Purge control solenoid valve system
P0500	Vehicle speed sensor system
P0606	Microcomputer malfunction
P0638	Throttle valve control servo circuit range/performance problem
P0642	Throttle position sensor power supply
P0657	Throttle valve control servo relay circuit malfunction
P1021	Oil feeder control valve system
P1233	Trustful check throttle position sensor (main)
P1234	Trustful check throttle position sensor (sub)
P1235	Trustful check air flow sensor
P1236	A/D converter system
P1237	Trustful check accelerator pedal position sensor
P1238	Air flow sensor trustful for torque monitoring
P1239	Trustful check engine speed
P1241	Torque monitoring
P1602	Communication malfunction (btween engine-ECU main processor and system LSI)
P1603	Battery backup circuit malfunction
P2100	Throttle valve control servo circuit (open)
P2101	Throttle valve control servo magneto malfunction
P2108	Throttle valve control servo processor malfunction
P2122	Accelerator pedal position sensor (main) circuit low input
P2123	Accelerator pedal position sensor (main) circuit high input
P2127	Accelerator pedal position sensor (sub) circuit low input
P2128	Accelerator pedal position sensor (sub) circuit high input

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Code No.	Diagnosis item
P2135	Throttle position sensor (main and sub) range/performance problem
P2138	Accelerator pedal position sensor (main and sub) range/performance problem
U1108	Combination meter time-out

⚠ CAUTION

The engine warning lamp illuminates steadily if any abnormality has occurred in the engine-ECU.

NOTE: The engine warning lamp flashes if the electronically controlled throttle valve system is forced to stop by activation of the fail-safe function.

METHOD FOR READING AND ERASING DIAGNOSIS CODES

Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-7.

DIAGNOSIS USING INCREASED SENSITIVITY DIAGNOSIS MODE

When the increased sensitivity diagnosis mode is selected on the M.U.T.-III, the engine-ECU shifts into the mode in which it causes the engine warning lamp to light and stores the relevant diagnosis code immediately after detection of a malfunction. Since this mode allows the ECU to determine and store the diagnosis code with a shorter delay time after detection of a malfunction (1 second instead of standard 4 seconds), it helps to reduce workload required for fault condition identification and post-repair checking operations. To revert from the increased sensitivity diagnosis mode to the standard sensitivity diagnosis mode, the ignition switch must be turned to the "LOCK" (OFF) position or the standard sensitivity mode must be re-selected on the M.U.T.-III. The diagnosis code and the freeze-frame data retained in memory during the increased sensitivity diagnosis mode must, if necessary, be recorded before performing the mode switching operation because they will be automatically erased as soon as the standard sensitivity diagnosis mode is re-selected.

Diagnosis Procedure

1. Connect the M.U.T.-III to the vehicle connector, set the engine-ECU diagnosis mode to the increased sensitivity diagnosis mode, and perform a road test.
2. Read diagnosis code(s) and repair the faulty location(s).
3. Either re-select the standard sensitivity diagnosis mode on the M.U.T.-III or turn the ignition switch to the "LOCK" (OFF) position and then back to the ON position.

NOTE: Turning the ignition switch to the "LOCK" (OFF) position has the effect of causing the engine-ECU to switch its diagnosis mode from the increased sensitivity diagnosis mode to the standard sensitivity diagnosis mode.

INSPECTION USING M.U.T.-III DATA LIST AND ACTUATOR TEST FUNCTIONS

Using the data list display function and actuator test function of the M.U.T.-III, you can check vehicle harnesses and components for any abnormalities. The data list display function allows inputs from sensors and outputs to actuators both in numerical value and graph formats. The actuator test function allows forcing desired actuators to operate (turning on an actuator and turning it off after predetermined period).

Diagnosis Procedure

1. Connect the M.U.T.-III to the vehicle connector and carry out necessary inspections using the data list function and/or actuator test function.
2. If any abnormality is found, inspect the relevant vehicle harnesses or components and repair them if necessary.
3. After the repair, check that the input/output levels have returned to normal ranges levels.
4. Clear any diagnosis code that has resulted from inspection and repair operations.
5. Disconnect the M.U.T.-III and perform a road test or other necessary tests to confirm that there are no problems remaining.

FREEZE FRAME DATA

When the engine-ECU detects a malfunction and stores the corresponding diagnosis code, it also stores the data showing the state of the engine at the time of malfunction detection. These data are called "freeze frame data". Analyzing the data using the M.U.T.-III will help you to perform troubleshooting efficiently.

NOTE: Freeze frame data are displayed in terms of the items listed below.

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DATA DISPLAY ITEM LIST

Item No.	Data		Unit/state
12	Air flow sensor		g/sec
13	Intake air temperature sensor		°C
21	Engine coolant sensor		°C
22	Crank angle sensor		r/min
24	Vehicle speed		km/h
44	Ignition timing		deg
79	Throttle position sensor (main)		mV
81	Long-term fuel consumption		%
82	Short-term fuel consumption		%
87	Calculation load value		%
88	Fuel control condition	Closed loop *1	CL
		Open loop *2	OL
		Open loop owing to drive condition *3	OL-DRV.
		Open loop owing to system malfunction *4	OL-SYS.
89	Fuel control condition		–

*NOTE: *1: A state in which fuel control is performed using oxygen sensor signals fed back to the engine-ECU.*

*NOTE: *2: A state in which the closed-loop conditions are not yet met, making the engine-ECU perform fuel control without feedback data from the oxygen sensors.*

*NOTE: *3: A state in which open-loop control is needed due to repeated acceleration and deceleration.*

*NOTE: *4: A state in which open-loop control is performed in consequence of a system malfunction.*

DRIVE CYCLE

The following three drive cycle patterns are performed on the diagnosis codes monitored during the vehicle driving. The vehicle driving requires the patterns to identify the fault. In other words, doing such a drive allows to regenerate any kind of trouble which involves illuminating the engine warming lamp (check engine lamp) and to verify the repair procedure has eliminated the trouble [the engine warming lamp (check engine lamp) is no longer illuminated].

⚠ CAUTION

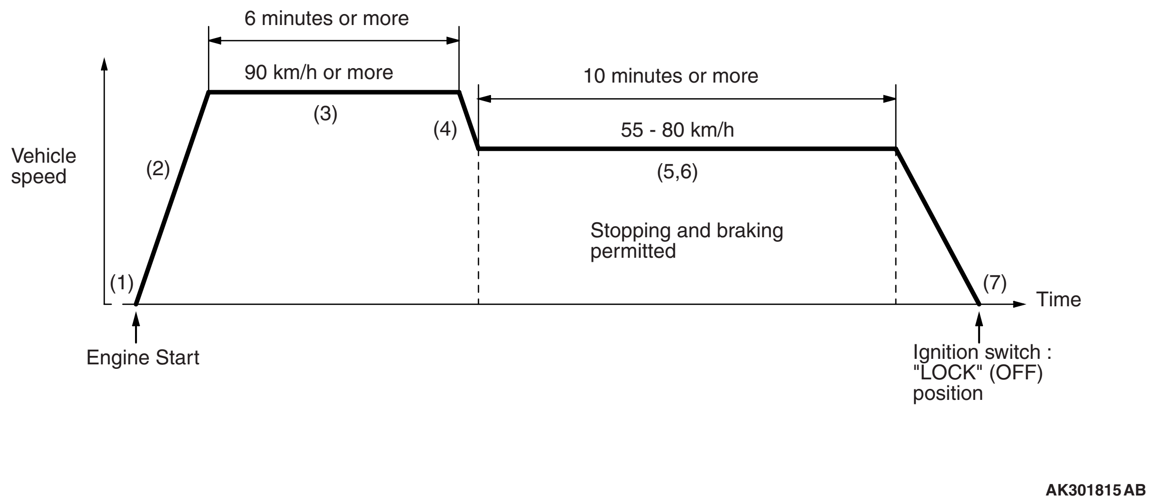
Two technicians should always be in the vehicle when carrying out a test drive.

NOTE: Check that the diagnosis code is not output before traveling in the drive cycle pattern. Erase the diagnosis code if it has been output.

DRIVE CYCLE PATTERN LIST

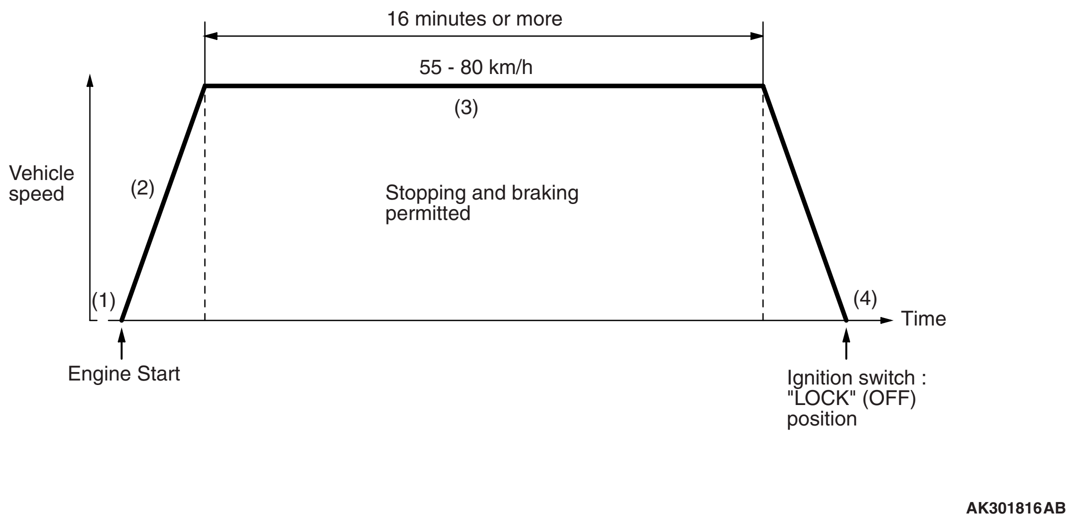
Procedure	Monitor item	Diagnosis code No.
1	Catalytic converter monitor	P0421
2	Oxygen sensor (front) monitor	P0130
3	Other monitor	P0135, P0136, P0141, P0300, P0301, P0302, P0303, P0304, P0325, P0500, P0638

Procedure 1

Catalytic converter monitor	
Diagnosis code No.	P0421
Drive cycle pattern	One trip monitor [from start to ignition switch to "LOCK" (OFF) position] will be completed while traveling with the following drive cycle pattern. It will take 16 minutes or more. 
Inspection condition	• Atmospheric temperature: –10°C or more
Test procedure	1. Engine: start 2. Accelerate until the vehicle speed is 90 km/h or more. 3. Travel for 6 minutes or more while keeping the vehicle speed at 90 km/h or more. 4. Decelerate until the vehicle speed is within 80 km/h or less. 5. While traveling at 55 – 80 km/h for 10 minutes or more, fully close the throttle at least once in 2 minutes and decelerate for 10 seconds or more. • Do not repeat deceleration too often. • Vehicle speed may go below 55 km/h after the deceleration. • Stopping and braking are permitted. (If stopped or drive at 55 km/h or less for more than 5 minutes the monitoring may be stopped. In this case please restart monitoring from the beginning.) 6. After completing the above deceleration, bring the vehicle speed back to 55 – 80 km/h and keep it in the range until starting the deceleration again. • Repeat the above deceleration at least 5 times. 7. Return the vehicle to the shop, then turn the ignition switch to "LOCK" (OFF) position.

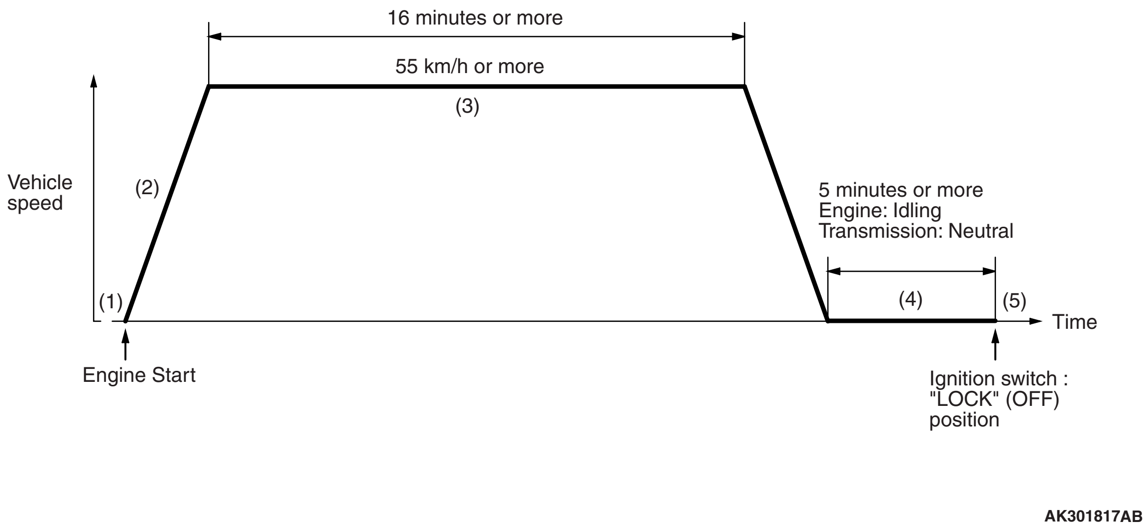
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Procedure 2

Oxygen sensor (front) monitor	
Diagnosis code No.	P0130
Drive cycle pattern	One trip monitor [from start to ignition switch to "LOCK" (OFF) position] will be completed while traveling with the following drive cycle pattern. It will take 16 minutes or more. 
Inspection conditions	• Engine coolant temperature: After engine warm up • Atmospheric temperature: –10°C or more
Test procedure	1. Engine: start 2. Accelerate until the vehicle speed is 55 – 80 km/h. 3. While keeping the accelerator pedal opening degree constant, keep the vehicle speed at 55 – 80km/h and travel for 16 minutes or more. • Stopping and braking during this operation are permitted. 4. Return the vehicle to the shop, then turn the ignition switch to "LOCK" (OFF) position.

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Procedure 3

Other monitor	
Diagnosis code No.	P0135, P0136, P0141, P0300, P0301, P0302, P0303, P0304, P0325, P0500, P0638
Drive cycle pattern	One trip monitor [from start to ignition switch to "LOCK" (OFF) position] will be completed while traveling with the following drive cycle pattern. It will take 21 minutes or more. 
Inspection conditions	• Engine coolant temperature: After engine warm up • Atmospheric temperature: –10°C or more
Test procedure	1. Engine: start 2. Accelerate until the vehicle speed is 55 km/h. 3. While keeping the accelerator pedal opening degree constant, keep the vehicle speed at 55 km/h and travel for 16 minutes or more. 4. Return the vehicle to the shop. 5. After stopping the vehicle, continue idling for 5 minutes, and then turn the ignition switch to "LOCK" (OFF) position.

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FAIL-SAFE/BACKUP FUNCTION

When the diagnosis function detects a malfunction in any of the main sensors, the fail-safe/backup function enables the vehicle to still be driven safely by using one of the pre-established control logics appropriate for the malfunctioning sensor.

CONTROL DETAILS BY FAIL-SAFE/BACKUP FUNCTION

Malfunctioning item	Control detail
Air flow sensor	1. Based on the throttle position sensor signal data and the crank angle sensor signal data (engine speed data), the ECU determines the basic injector activation time and basic ignition timing from a pre-established map. 2. The ECU does not control the idling speed.
Intake air temperature sensor	The ECU performs control assuming a 25°C intake air temperature.
Engine coolant temperature sensor	The ECU performs control assuming a 80°C engine coolant temperature. (This control persists until the ignition switch is turned to the "LOCK" (OFF) position even after the engine coolant sensor starts re-supplying normal signals.)
Oxygen sensor <front>	Air/fuel ratio closed loop control is not performed.
Oxygen sensor <rear>	Per forms the closed loop control of the air/fuel ratio by using only the signal of the oxygen sensor (front) installed on the front side of the catalytic converter.
Throttle position sensor (main)	• The ECU controls the throttle valve position using signals from the throttle position sensor (sub). • The ECU assumes the accelerator position to be at an approximately half-stroke position. • Engine speed feedback control is prohibited. • The ECU cuts off fuel supply when the engine speed exceeds 3,000 r/min. • When the throttle position sensor (sub) is also malfunctioning, the ECU deactivates the electronic-controlled throttle valve system and limits the engine output to a certain low level.
Accelerator pedal position sensor (main)	• The ECU determines the accelerator pedal position using the signals from the accelerator pedal position sensor (sub). However, the pedal stroke position thus determined is interpreted as approximately a half of the normal state position. • The ECU cuts off fuel supply when the engine speed exceeds 3,000 r/min. • When the accelerator pedal position sensor (sub) is also malfunctioning, the ECU deactivates the electronic-controlled throttle valve system and limits the engine output to a certain low level.
Throttle position sensor (sub)	• The ECU controls the throttle valve position using signals from the throttle position sensor (main). • The ECU assumes the accelerator position to be an approximately half-stroke position. • The ECU cuts off fuel supply when the engine speed exceeds 3,000 r/min. • When the throttle position sensor (main) is also malfunctioning, the ECU deactivates the electronic-controlled throttle valve system and limits the engine output to a certain low level.
Ignition coil (power transistor)	The ECU stops fuel injection into the cylinder with abnormal ignition.
Detonation sensor	The ECU fixes the ignition timing to a one safe enough against detonation.

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Malfunctioning item	Control detail
Camshaft position sensor	• The ECU resumes the conditions having existed before the sensor malfunction was determined and use them for the subsequent control. • The ECU cuts fuel supply 4 seconds after detection of the malfunction (only when the No. 1 cylinder top dead center is not sensed at all after the ignition switch is turned to ON).
Throttle valve control microcomputer	The ECU controls the engine output with the electronic-controlled throttle valve system deactivated.
Alternator FR terminal	The ECU prohibits the control in which the alternator output is limited depending on electric load (as a result, the alternator operates free of such a control).
Throttle valve control servo	The ECU controls the engine output with the electronic-controlled throttle valve system deactivated.
Throttle valve position feedback	The ECU controls the engine output with the electronic-controlled throttle valve system deactivated.
Accelerator pedal position sensor (sub)	• The ECU determines the accelerator pedal position using the signals from the accelerator pedal position sensor (main). However, the pedal stroke position thus determined is interpreted as approximately a half of the normal state position. • The ECU cuts off fuel supply when the engine speed exceeds 3,000 r/min. • When the accelerator pedal position sensor (main) is also malfunctioning, the ECU deactivates the electronic-controlled throttle valve system and limits the engine output to a certain low level.
Manifold absolute pressure sensor	The ECU performs control assuming a 101 kPa manifold absolute pressure.

NOTE: The engine warning lamp is caused to flash when the electronic-controlled throttle valve system is deactivated.

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INSPECTION CHART FOR DIAGNOSIS CODES

M1131151002426

⚠ CAUTION

If the ignition switch is turned to the ON position with a connector or other electrical connections disconnected during troubleshooting of a system, a diagnosis code may be set for other systems. After finishing troubleshooting, check diagnosis codes for all systems, and if any codes have been set, erase these codes.

Code	Diagnosis item	Reference page
P0011	Variable valve timing system	P.13B-24
P0090	Fuel pressure solenoid valve system	P.13B-25
P0100	Air flow sensor system	P.13B-31
P0105	Barometric pressure sensor system	P.13B-37
P0110	Intake air temperature sensor system	P.13B-38
P0115	Engine coolant temperature sensor system	P.13B-45
P0122	Throttle position sensor (main) circuit low input	P.13B-53
P0123	Throttle position sensor (main) circuit high input	P.13B-57
P0125	Feedback system monitor	P.13B-60
P0130	Oxygen sensor (front) system	P.13B-65
P0135	Oxygen sensor (front) heater system	P.13B-72
P0136	Oxygen sensor (rear) system	P.13B-78
P0141	Oxygen sensor heater (rear) system	P.13B-84
P0170	Abnormal fuel system	P.13B-90
P0201	No. 1 injector system	P.13B-92
P0202	No. 2 injector system	P.13B-97
P0203	No. 3 injector system	P.13B-102
P0204	No. 4 injector system	P.13B-107
P0222	Throttle position sensor (sub) circuit low input	P.13B-112
P0223	Throttle position sensor (sub) circuit high input	P.13B-116
P0243	Waste gate solenoid valve system	P.13B-119
P0300	Random/multiple cylinder misfire detected	P.13B-125
P0301	No. 1 cylinder misfire detected	P.13B-126
P0302	No. 2 cylinder misfire detected	P.13B-129
P0303	No. 3 cylinder misfire detected	P.13B-132
P0304	No. 4 cylinder misfire detected	P.13B-135
P0325	Detonation sensor system	P.13B-138
P0335	Crank angle sensor system	P.13B-142
P0340	Camshaft position sensor system	P.13B-151
P0421	Warm up catalyst malfunction	P.13B-160
P0443	Purge control solenoid valve system	P.13B-161
P0500	Vehicle speed signal system	P.13B-166

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Code	Diagnosis item	Reference page
P0513	Immobilizer malfunction	P.13B-167
P0603	EEP ROM system	P.13B-169
P0606	Microcomputer malfunction	P.13B-169
P0622	Alternator FR terminal system	P.13B-170
P0638	Throttle valve control circuit range/performance problem	P.13B-174
P0642	Throttle position sensor power supply	P.13B-177
P0657	Throttle valve control servo relay circuit malfunction	P.13B-178
P1021	Oil feeder control valve system	P.13B-188
P1231	Trustfui check ASC	P.13B-194
P1233	Trustful check throttle position sensor (main)	P.13B-194
P1234	Trustful check throttle position sensor (sub)	P.13B-195
P1235	Trustful check air flow sensor/manifold absolute pressure senor	P.13B-195
P1236	A/D converter system	P.13B-196
P1237	Trustful check accelerator pedal position sensor	P.13B-196
P1238	Air flow sensor trustful for torque monitoring	P.13B-197
P1239	Trustful check engine speed	P.13B-198
P1240	Trustful check ignition angle	P.13B-198
P1241	Torque monitoring	P.13B-199
P1602	Communication malfunction (btween engine-ECU main processor and system LSI)	P.13B-201
P1603	Battery backup circuit Malfunction	P.13B-202
P2100	Throttle valve control servo circuit (open)	P.13B-205
P2101	Throttle valve control servo magneto malfunction	P.13B-209
P2108	Throttle valve control servo processor malfunction	P.13B-212
P2122	Accelerator pedal position sensor (main) circuit low input	P.13B-212
P2123	Accelerator pedal position sensor (main) circuit high input	P.13B-217
P2127	Accelerator pedal position sensor (sub) circuit low input	P.13B-220
P2128	Accelerator pedal position sensor (sub) circuit high input	P.13B-224
P2135	Throttle position sensor (main and sub) range/performance problem	P.13B-227
P2138	Accelerator pedal position sensor (main and sub) range/performance problem	P.13B-229
U1073	Bus off	P.13B-235
U1102	ABS-ECU time-out	P.13B-236
U1106	EPS time-out	P.13B-237
U1108	Combination meter time-out	P.13B-239
U1110	A/C-ECU time-out	P.13B-240

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INSPECTION CHART FOR TROUBLE SYMPTOMS

M1131151501956

Items	Trouble symptom		Inspection procedure No.
Communication with M.U.T.-III is impossible	Communication with engine-ECU is not Possible		1
Engine warning lamp	The engine warning lamp does not illuminate right after the ignition switch is turned to the ON position		2
	The engine warning lamp remains illuminating and never goes out		3
Starting	Starting impossible (No initial combustion)	The starter is impossible to operate.	4
	Starting impossible (Starter operative but no initial combustion)	The starter is operative and cranks the engine, but no combustion takes place in cylinders and thus the engine is not started.	5
	Starting impossible (Initial combustion but no complete combustion)	Initial combustion occurs but the engine stalls soon later due to incomplete combustion.	6
	Improper starting (Long time to start)	It takes long cranking time to start the engine.	
Improper idling	Unstable idling (Rough idling, hunting)	Engine speed is not constant (varies) during idling. This condition is usually detectable by movement of the tachometer needle as well as by engine vibration transmitted to the steering wheel, shift lever, vehicle body, and so on.	7
	Improper idling speed (Too high or too low)	The idling speed is not within the normal speed range.	
	Engine stalls during idling (Die out)	The engine stalls during idling regardless of vehicle movement.	
Engine stalls	The engine stalls when starting the car (Pass Out)	The engine stalls during operation or when the accelerator pedal is depressed while the engine is idling.	8
	The engine stalls when decelerating	The engine stalls when the vehicle decelerates.	

Items	Trouble symptom		Inspection procedure No.
Driving	Engine does not revolve up	The engine speed does not increase even the accelerator pedal is depressed.	9
	Hesitation, sag	The vehicle speed (engine speed) responds with too much delay when the accelerator pedal is depressed for acceleration from a certain vehicle speed, or the vehicle speed (engine speed) drops transiently during acceleration. These phenomena are called "hesitation" and strong hesitation is called "sag".	10
	Stumble	When starting the vehicle, the engine speed responds with too much delay to initial operation of the accelerator pedal.	
	Poor acceleration	The engine operates smoothly during constant-speed driving, but during acceleration, the rise in speed is insufficient compared with the one expected for the degree of throttle valve opening. In addition, the engine fails to reach the maximum speed.	
	Surge	The vehicle jolts longitudinally and repeatedly during constant-speed driving or acceleration.	
	The feeling of impact or vibration when accelerating	Large impact is felt during acceleration.	11
	The feeling of impact or vibration when decelerating	Large impact is felt during deceleration.	12
	Knocking	The engine makes a pounding or clanking noise that would be generated if a cylinder were hammered, deteriorating the drive quality.	13
	Ignition timing offset	The basic ignition timing does not conform to the standard timing.	14
Stopping	Run on (Dieseling)	The engine continues to run even after the ignition switch is turned to the LOCK (OFF) position.	15
Exhaust gas	Odor, white smoke, black smoke, and high concentration of CO/HC during idling	Exhaust gas smells very nasty, includes white or black smoke and/or contains carbon monoxide/hydrocarbons at high concentration during idling.	16

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Items	Trouble symptom		Inspection procedure No.
Battery charging capacity	Battery run down	Battery runs down prematurely or battery's charging capacity is insufficient.	17
Engine cooling performance	Overheating	Engine coolant temperature rises to an abnormally high level.	18
	Abnormal rotation of fan motor	The fan motor operates whenever the ignition switch is turned to the ON position regardless of the engine coolant temperature.	19
Air conditioner performance	Poor A/C performance	The air from the air conditioner is not cool or at a temperature too much different from the target temperature.	20

TROUBLE SYMPTOMS TABLE

⚠ CAUTION

If the ignition switch is turned to the ON position with a connector or other electrical connections disconnected during troubleshooting of a system, a diagnosis code may be set for other systems. After finishing troubleshooting, check diagnosis codes for all systems, and if any codes have been set, erase these codes.

Inspection procedure	Trouble symptom	Reference page
1	Communication with engine-ECU is not possible	P.13B-242
2	The engine warning lamp does not illuminate right after the ignition switch is turned to the "ON" position.	P.13B-244
3	The engine warning lamp remains illuminating and never goes out	P.13B-244
4	Starting impassible (No initial combustion)	P.13B-245
5	Starting impossible (Starter operative but no initial combustion)	P.13B-252
6	Starting impossible (Initial combustion but no complete combustion)	P.13B-254
	Improper starting (Long time to start)	
7	Unstable idling (Rough idling, hunting)	P.13B-256
	Improper idling speed (Too high or too low)	
	Engine stalls during idling (Die out)	
8	The engine stalls when starting the car (Pass out)	P.13B-259
	The engine stalls when decelerating	
9	Engine does not revolve up	P.13B-260
10	Hesitation, sag	P.13B-261
	Stumble	
	Poor acceleration	
	Surge	
11	The feeling of impact or vibration when accelerating	P.13B-262

Inspection procedure	Trouble symptom	Reference page
12	The feeling of impact or vibration when decelerating	P.13B-263
13	Knocking	P.13B-264
14	Ignition timing offset	P.13B-264
15	Run on (Dieseling)	P.13B-266
16	Odor, white smoke, black smoke, and high-concentration CO/HC during idling	P.13B-266
17	Battery run down	P.13B-268
18	Overheating	P.13B-272
19	Abnormal rotation of fan motor	P.13B-273
20	Poor A/C performance	P.13B-281
21	Engine ECU power supply, engine control relay, ignition switch-IG1 system	P.13B-282
22	Fuel pump system	P.13B-290
23	Fan control relay system	P.13B-303
24	A/C compressor relay system	P.13B-317
25	Stop lamp switch system	P.13B-323
26	Ignition circuit system	P.13B-327
27	Clutch switch system	P.13B-331

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INSPECTION PROCEDURE FOR DIAGNOSIS CODES

Code No. P0011: Variable Valve Timing System

FUNCTION

- The engine-ECU checks the variable valve timing system for malfunction.

TROUBLE JUDGMENT

Check Conditions
- After Engine starts
- Oil feeder control valve is in OFF position.
- Oil feeder control valve is normal.
- Camshaft position sensor and crank angle sensor are normal.

Judgement Criterion
- While detected phase angle is at more advanced angle than most retarded angle advanced by 15° for 10 seconds

Check Conditions
- Ignition switch is in "ON" position.

Judgement Criterion
- V.V.T. monitor current is abnormal.

Check Conditions
- Ignition switch is in "ON" position.

Judgement Criterion
- Battery voltage is more than 9.0 V.
- V.V.T. monitor current is abnormal.

Check Conditions
- Ignition switch is in "ON" position.

Judgement Criterion
- Battery voltage is more than 9.0 V.
- Oil feeder control valve is in ON position.
- V.V.T. monitor current is abnormal.

PROBABLE CAUSES

- Failed oil feeder control valve
- Oil passage of variable valve timing control system clogged
- Failed variable valve timing sprocket operation mechanism stuck
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Check oil feeder control valve itself.
- Check oil feeder control valve itself (Refer to P.13B-369).

Q: Is the check result normal?
YES : Go to Step 2.
NO : Replace oil feeder control valve.

STEP 2. Check oil passage of variable valve timing control system for being clogged.

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair.

STEP 3. Check variable valve timing sprocket operation mechanism for being stuck.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair.

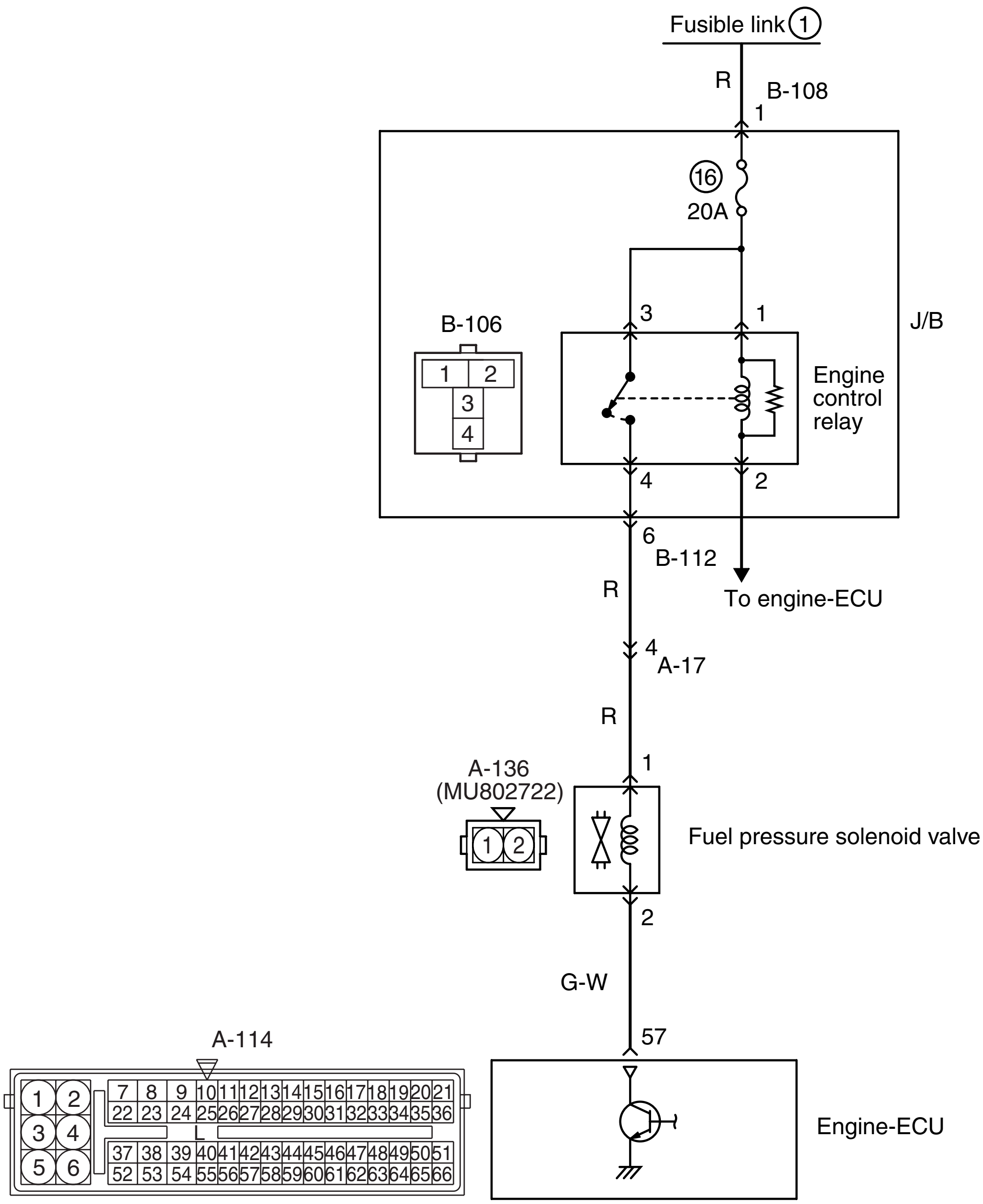
STEP 4. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code

Q: Is the diagnosis code output?
YES : Replace engine-ECU
NO : Intermittent malfunction (Refer to Group 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

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Code No. P0090: Fuel Pressure control Solenoid Valve System

Fuel Pressure Solenoid Valve Circuit



Wire colour code
B: Black LG: Light green G: Green L: Blue W: White Y: Yellow SB: Sky blue BR: Brown O: Orange GR: Gray
R: Red P: Pink V: Violet

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OPERATION

- Power is supplied to the fuel pressure control solenoid valve (terminal No. 1) from the engine relay (terminal No. 4).
- The engine-ECU (terminal No. 57) makes the power transistor in the unit be in ON position, and that makes currents go to the fuel pressure control solenoid valve (terminal No. 2).

FUNCTION

- In response to a signal from the engine-ECU, the fuel pressure control solenoid valve switches the introduction pressure into the fuel pressure regulator between negative pressure of the intake manifold and barometric pressure.

TROUBLE JUDGMENT

Check Condition

- While engine running
- Battery voltage is more than 10 V and is less than 16 V.

Judgement Criterion

- Surge voltage cannot be detected within the time when the fuel pressure solenoid valve has changed from ON to OFF.

PROBABLE CAUSES

- Failed fuel pressure control solenoid valve
- Open/short circuit in fuel pressure control solenoid valve circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III actuator test

- Item 09: Fuel pressure control solenoid valve

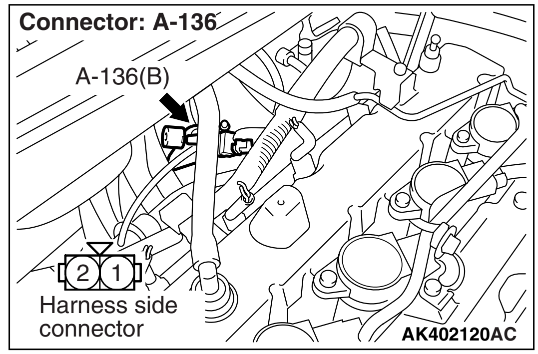
OK: Operating sound can be heard and the valve vibrates.

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

NO : Go to Step 2 .

STEP 2. Connector check: A-136 fuel pressure control solenoid valve connector

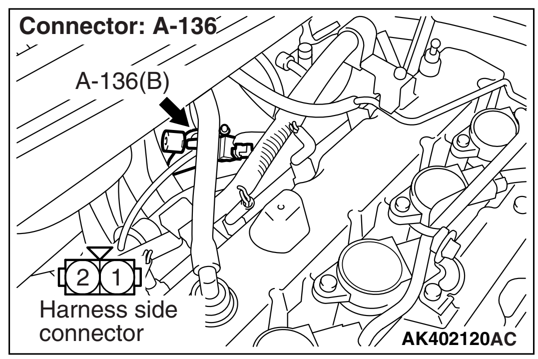


Q: Is the check result normal?

YES : Go to Step 3 .

NO : Repair or replace.

STEP 3. Perform resistance measurement at A-136 fuel pressure control solenoid valve connector.



- Disconnect connector, and measure at solenoid valve side.
- Resistance between Terminals No. 1 and No. 2.

OK: 29 – 35 Ω (at 20°C)

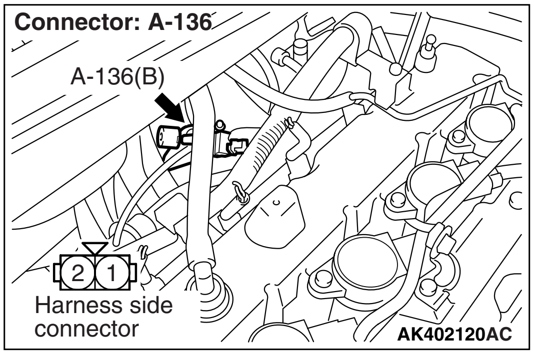
Q: Is the check result normal?

YES : Go to Step 4 .

NO : Replace fuel pressure control solenoid valve.

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STEP 4. Perform voltage measurement at A-136 fuel pressure control solenoid valve connector.



- Disconnect connector and measure at harness side.
- Ignition switch: ON
- Voltage between Terminal No. 1 and earth.

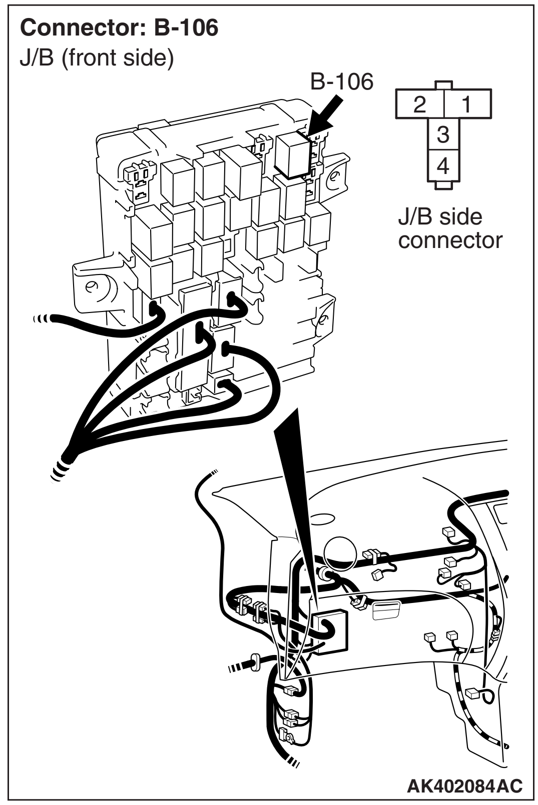
OK: System voltage

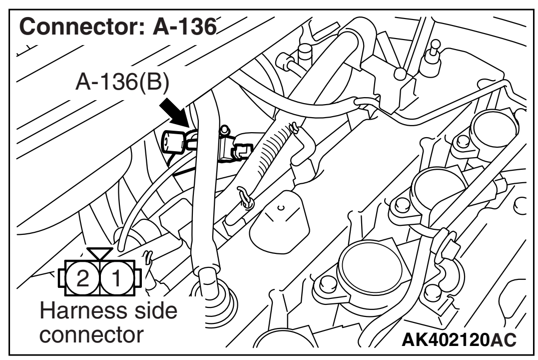
Q: Is the check result normal?

YES : Go to Step 6 .

NO : Go to Step 5 .

STEP 5. Connector check: B-106 engine control relay connector





Q: Is the check result normal?

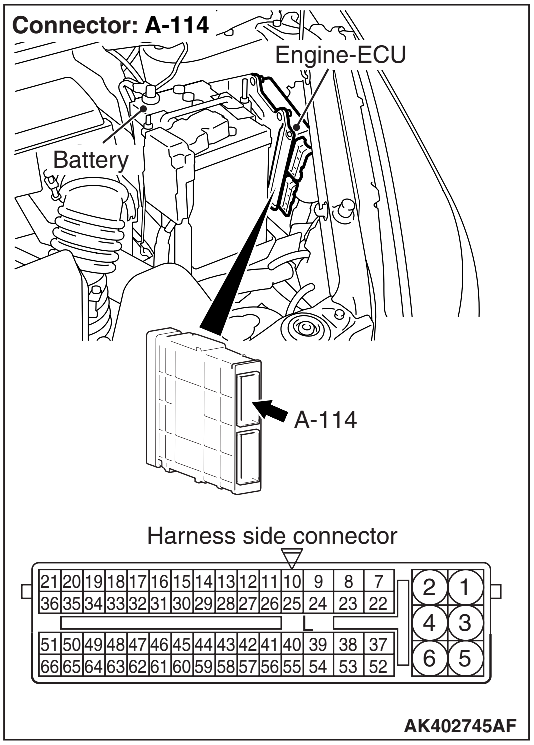
YES : Check intermediate connectors A-17 and B-112, and repair if necessary. If intermediate connectors are normal, check and repair harness between A-136 (terminal No. 1) fuel pressure control solenoid valve connector and B-106 (terminal No. 4) engine control relay connector.

- Check power supply line for open/short circuit.

NO : Repair or replace.

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STEP 6. Perform voltage measurement at A-114 engine-ECU connector.



- Disconnect connector and measure at harness side.
- Ignition switch: ON
- Voltage between terminal No. 57 and earth.

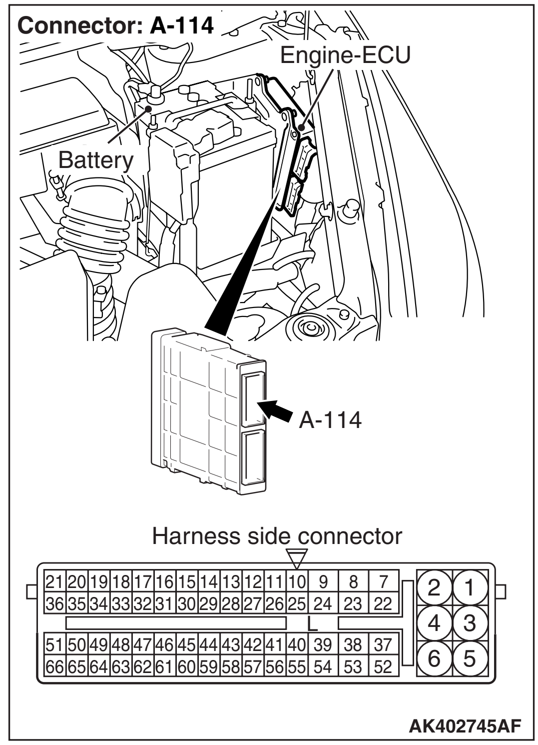
OK: System voltage

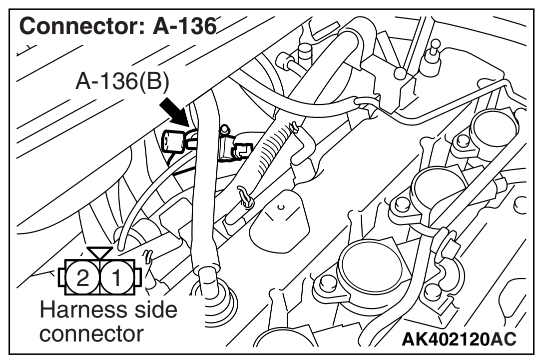
Q: Is the check result normal?

YES : Go to Step 8 .

NO : Go to Step 7 .

STEP 7. Connector check: A-114 engine-ECU connector





Q: Is the check result normal?

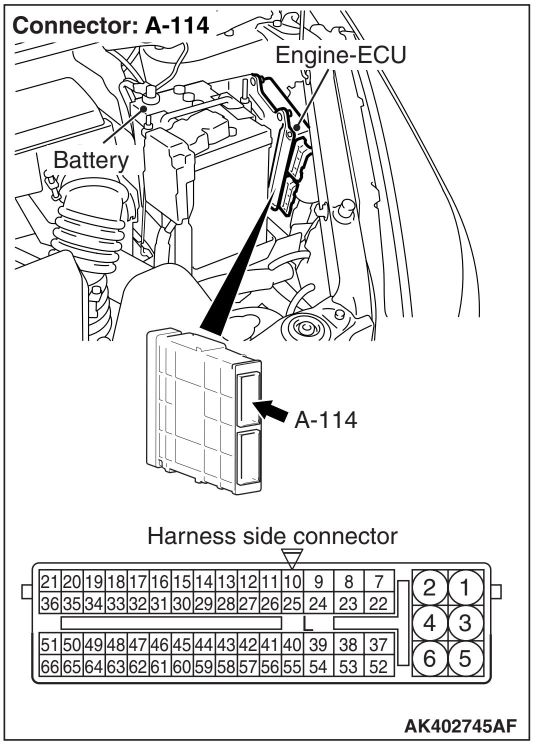
YES : Check and repair harness between A-136 (terminal No. 2) fuel pressure solenoid valve connector and A-114 (terminal No. 57) engine-ECU connector.

- Check output line for open/short circuit.

NO : Repair or replace.

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STEP 8. Connector check: A-114 engine-ECU connector

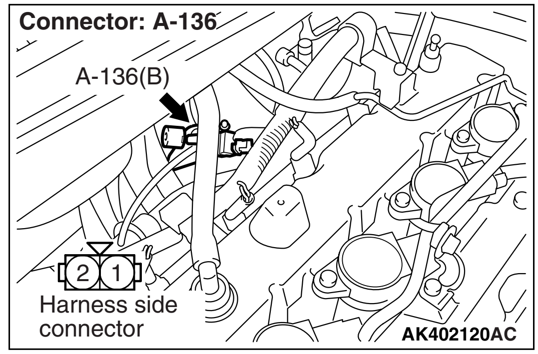


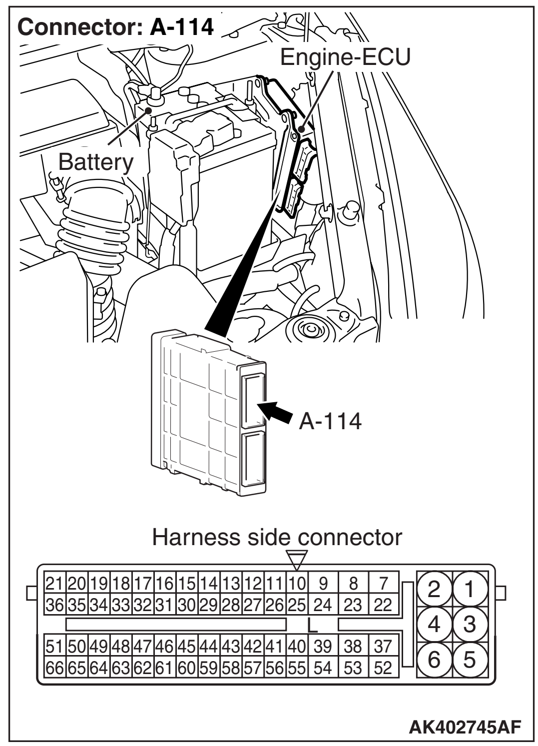
Q: Is the check result normal?

YES : Go to Step 9 .

NO : Repair or replace.

STEP 9. Check harness between A-136 (terminal No. 2) fuel pressure solenoid valve connector and A-114 (terminal No. 57) engine-ECU connector.





- Check output line for damage.

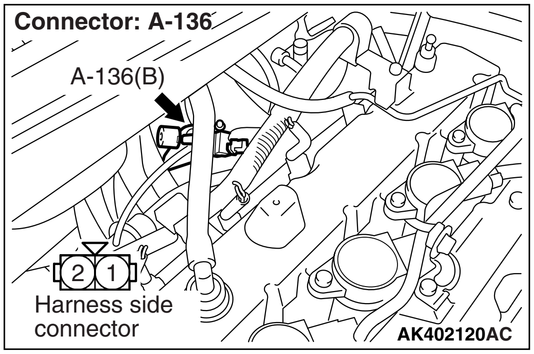
Q: Is the check result normal?

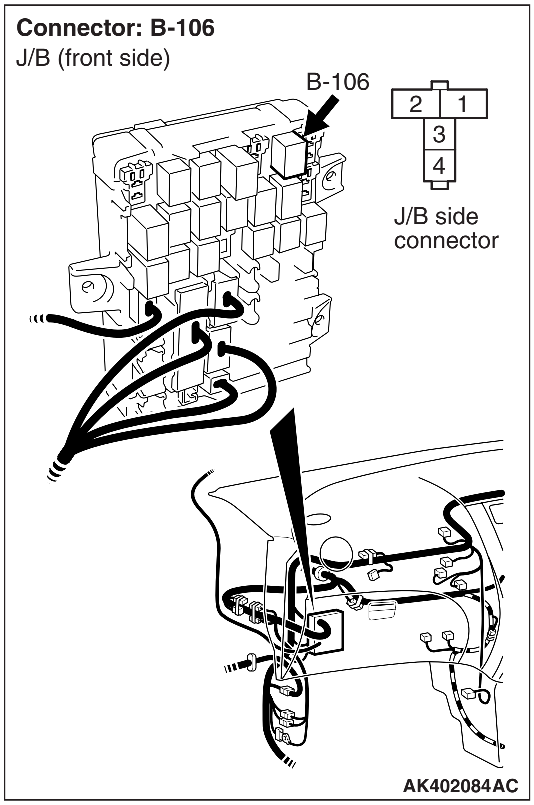
YES : Go to Step 10 .

NO : Repair.

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STEP 10. Check harness between A-136 (terminal No. 1) fuel pressure control solenoid valve connector and B-106 (terminal No. 4) engine control relay connector.





NOTE: Before checking harness, check intermediate connectors A-17 and B-112, and repair if necessary.

- Check power supply line for damage.

Q: Is the check result normal?

YES : Go to Step 11 .

NO : Repair.

STEP 11. M.U.T.-III actuator test

- Item 09: Fuel pressure solenoid valve

OK: Operating sound can be heard and the valve vibrates.

Q: Is the check result normal?

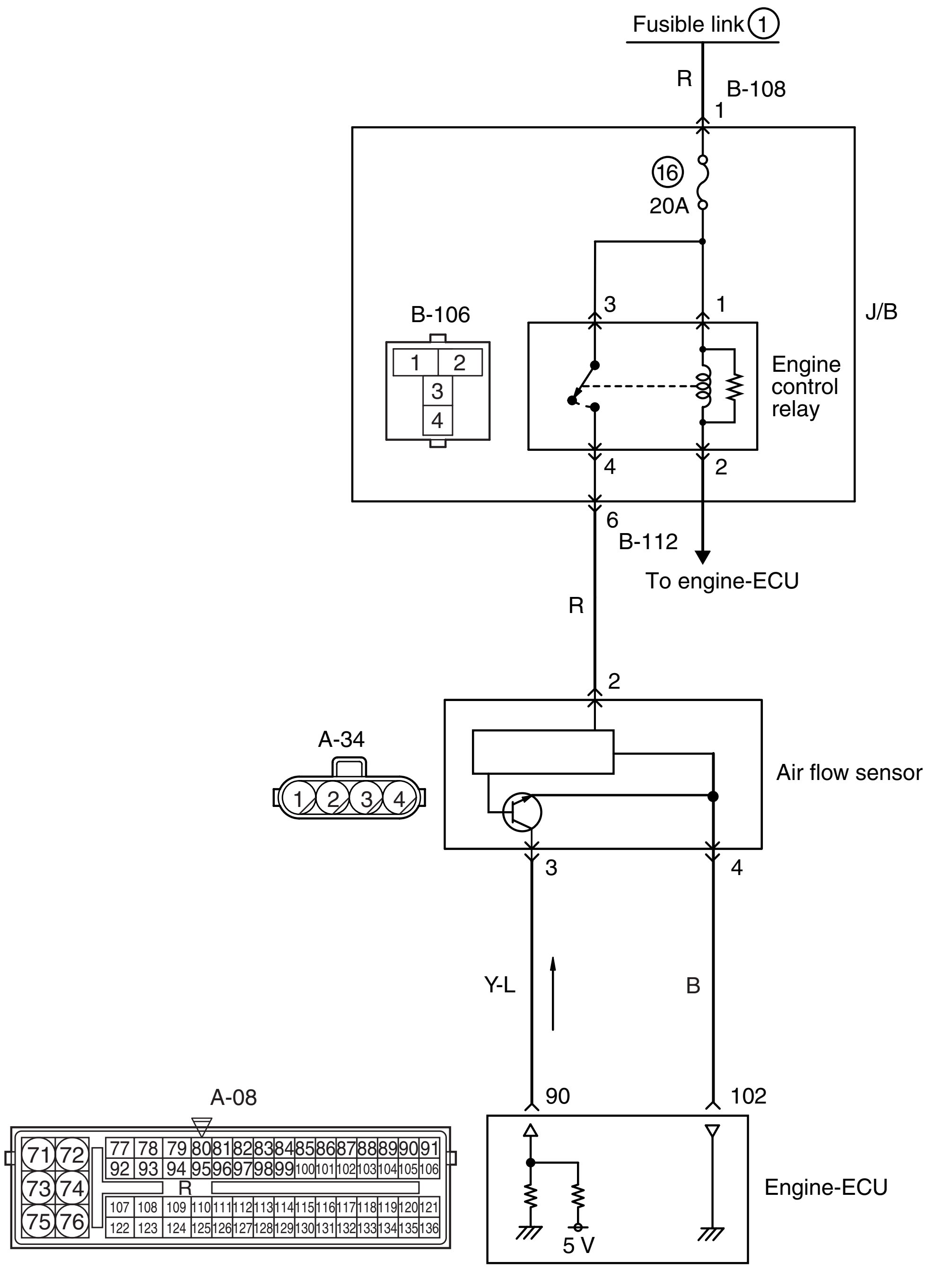
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

NO : Replace engine-ECU.

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Code No. P0100: Air Flow Sensor System

Air Flow Sensor Circuit



Wire colour code
B: Black LG: Light green G: Green L: Blue W: White Y: Yellow SB: Sky blue BR: Brown O: Orange GR: Gray
R: Red P: Pink V: Violet P: Purple

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Main Index
Group TOC

OPERATION

- Power is supplied to the air flow sensor (terminal No. 2) through engine control relay (terminal No. 4), and the air flow sensor (terminal No. 4) is earthed to the engine-ECU (terminal No. 102).
- The sensor output signal is input to the engine-ECU (terminal No. 90) from the air flow sensor output terminal (terminal No. 3).

FUNCTION

- The air flow sensor outputs a current corresponding to the intake of air.
- In response to the air flow sensor output and engine speed signal, the engine-ECU determines the basic injection time for the injectors.

TROUBLE JUDGEMENT

Check Condition

- 3 seconds later from when ignition switch is in ON position.
- While engine running

Judgement Criterion

- Sensor output voltage is less than 0.2 V for 4 seconds.

Or

- Sensor output voltage is more than 4.9 V for 4 seconds.

PROBABLE CAUSES

- Failed air flow sensor
- Open/short circuit in air flow sensor circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list

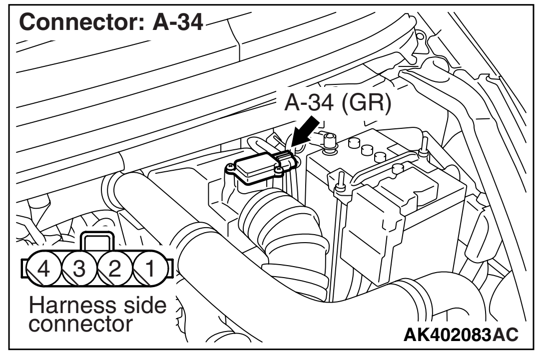
- Refer to Data List Reference Table P.13B-335.
  a. Item 12: air flow sensor

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

NO : Go to Step 2 .

STEP 2. Connector check: A-34 air flow sensor connector

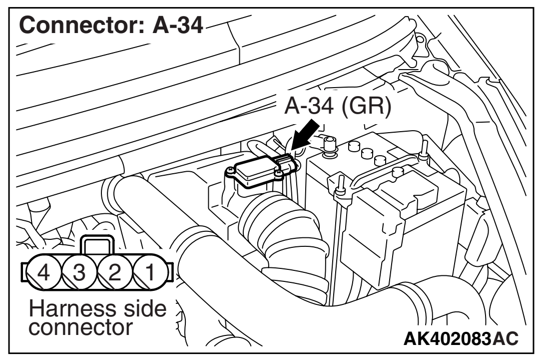


Q: Is the check result normal?

YES : Go to Step 3 .

NO : Repair or replace.

STEP 3. Perform voltage measurement at A-34 air flow sensor connector.



- Disconnect connector, and measure at harness side.
- Ignition switch: ON
- Voltage between terminal No. 2 and earth.

OK: System voltage

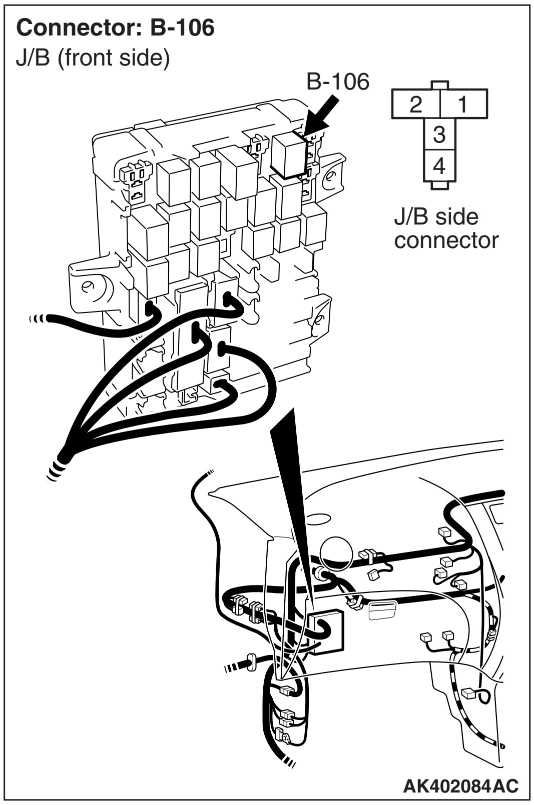
Q: Is the check result normal?

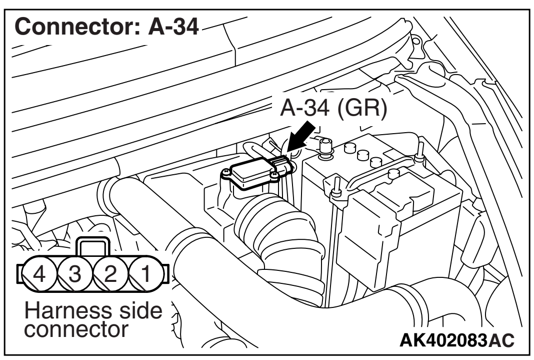
YES : Go the Step 5 .

NO : Go the Step 4 .

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STEP 4. Connector check: B-106 engine control relay connector





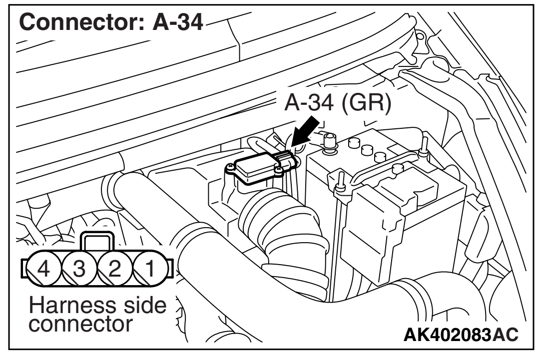
Q: Is the check result normal?

YES : Check intermediate connector B-112, and repair if necessary. If the intermediate connector is normal, check and repair the harness between A-34 (terminal No. 2) air flow sensor connector and B-106 (terminal No. 4) engine control relay connector.

- Check power supply line for open/short circuit.

NO : Repair or replace.

STEP 5. Perform resistance measurement at A-34 air flow sensor connector.



- Disconnect connector and measure at harness side.
- Resistance between terminal No. 4 and earth.

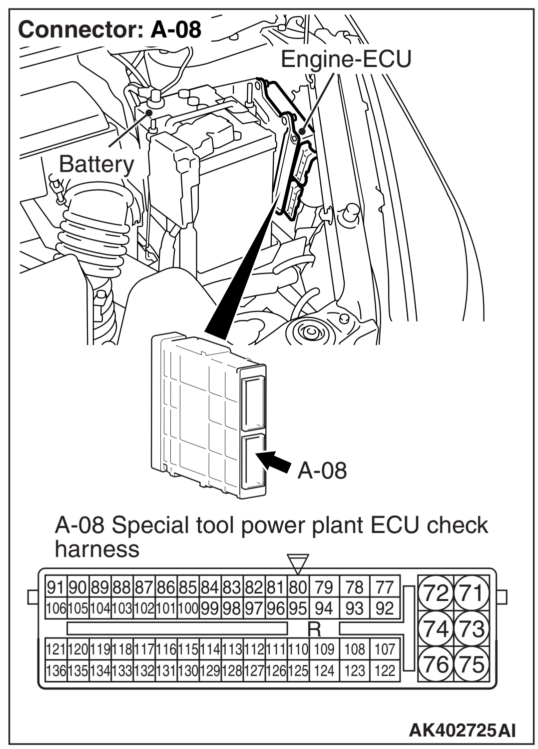
OK: Continuity (2 Ω or less)

Q: Is the check result normal?

YES : Go to Step 9 .

NO : Go to Step 6 .

STEP 6. Connector check: A-08 engine-ECU connector



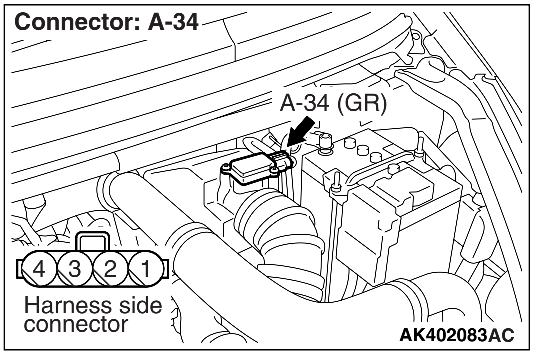
Q: Is the check result normal?

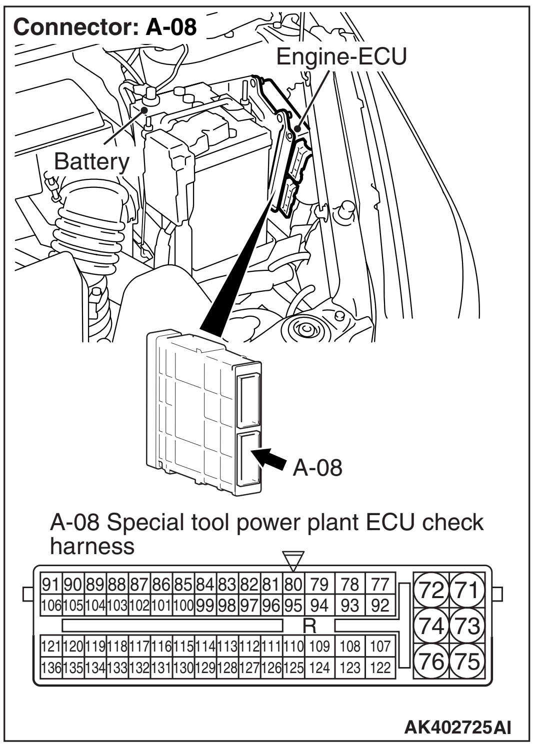
YES : Go to Step 7 .

NO : Repair or replace.

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STEP 7. Check harness between A-34 (terminal No. 4) air flow sensor connector and A-08 (terminal No. 102) engine-ECU connector.





- Check earthing line for open circuit and damage.

Q: Is the check result normal?

YES : Go to Step 8 .

NO : Repair.

STEP 8. M.U.T.-III data list

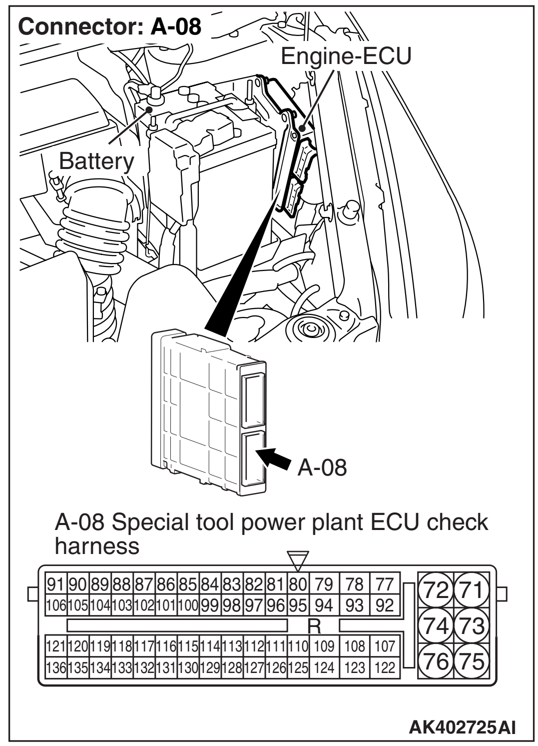
- Refer to Data List Reference Table P.13B-335.
  - a. Item 12: Air flow sensor

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to Group 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

NO : Replace engine-ECU

STEP 9. Connector check: A-08 engine-ECU connector



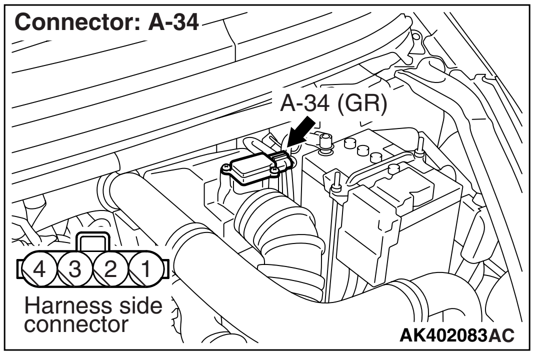
Q: Is the check result normal?

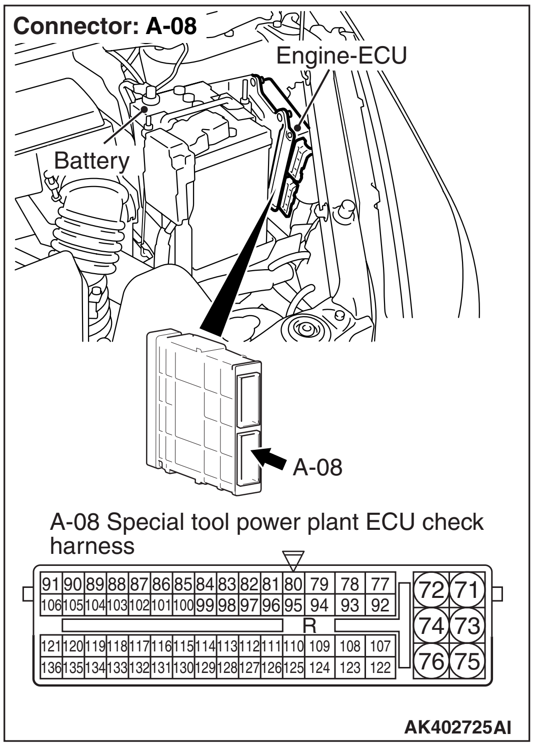
YES : Go to Step 10 .

NO : Repair or replace.

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STEP 10. Check harness between A-34 (terminal No. 3) air flow sensor connector and A-08 (terminal No. 90) engine-ECU connector.

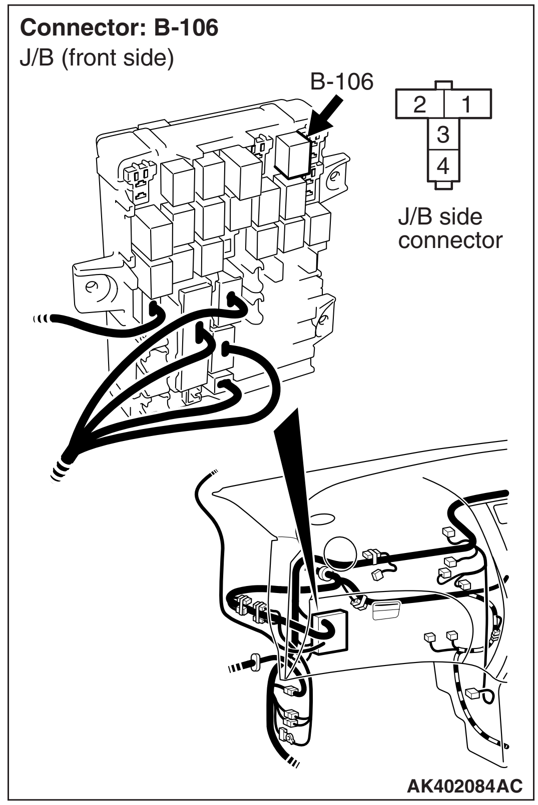




- Check output line for open/short circuit and damage.

Q: Is the check result normal?
YES : Go to Step 11 .
NO : Repair.

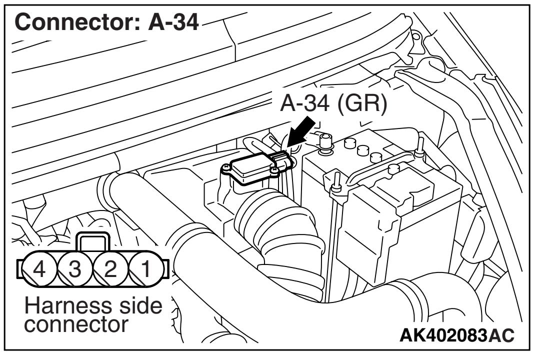
STEP 11. Connector check: B-106 engine control relay connector

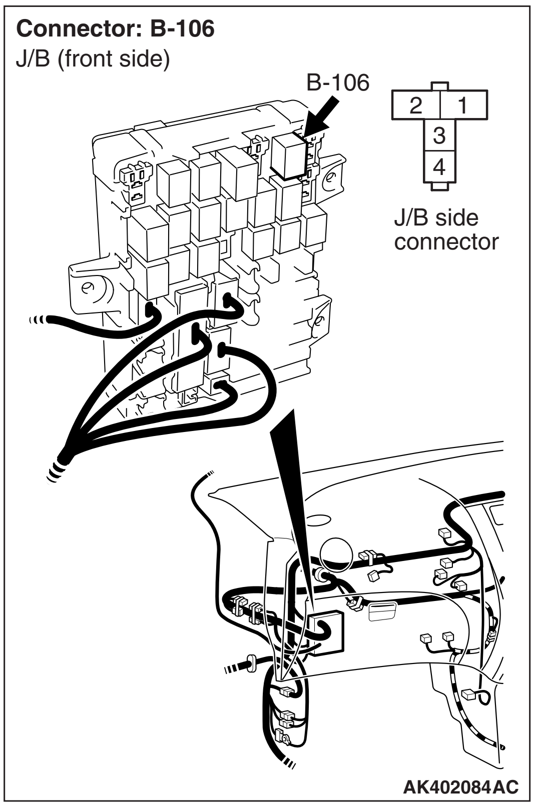


Q: Is the check result normal?
YES : Go to Step 12 .
NO : Repair or replace.

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STEP 12. Check harness between A-34 (terminal No. 2) air flow sensor connector and B-106 (terminal No. 4) engine control relay connector.





NOTE: Before checking harness, check intermediate connector B-112, and repair if necessary.

- Check power supply line for damage.

Q: Is the check result normal?

YES : Go to Step 13 .

NO : Repair.

STEP 13. M.U.T.-III data list

- Refer to Data List Reference Table P.13B-335.
  a. Item 12: Air flow sensor

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to Group 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

NO : Go to Step 14 .

STEP 14. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code after air flow sensor replacement

Q: Is the diagnosis code output?

YES : Replace engine-ECU.

NO : Check end.

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Code No. P0105: Barometric Pressure Sensor System

FUNCTION

- The barometric pressure sensor converts the barometric pressure to a voltage signal and inputs the signal to the engine-ECU.
- In response to the signal, the engine-ECU corrects the fuel injection amount, etc.

TROUBLE JUDGEMENT

Check Conditions

- 2 seconds later from when ignition switch is in ON position
- Battery voltage is more than 8.0 V.

Or

- 2 seconds later from when engine starts
- Battery voltage is more than 8.0 V.

Judgement Criterion

- Sensor output voltage is less than 0.2 V for 4 seconds.

Or

- Sensor output voltage is more than 4.5 V for 4 seconds.

PROBABLE CAUSE

- Failed barometric pressure sensor

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code

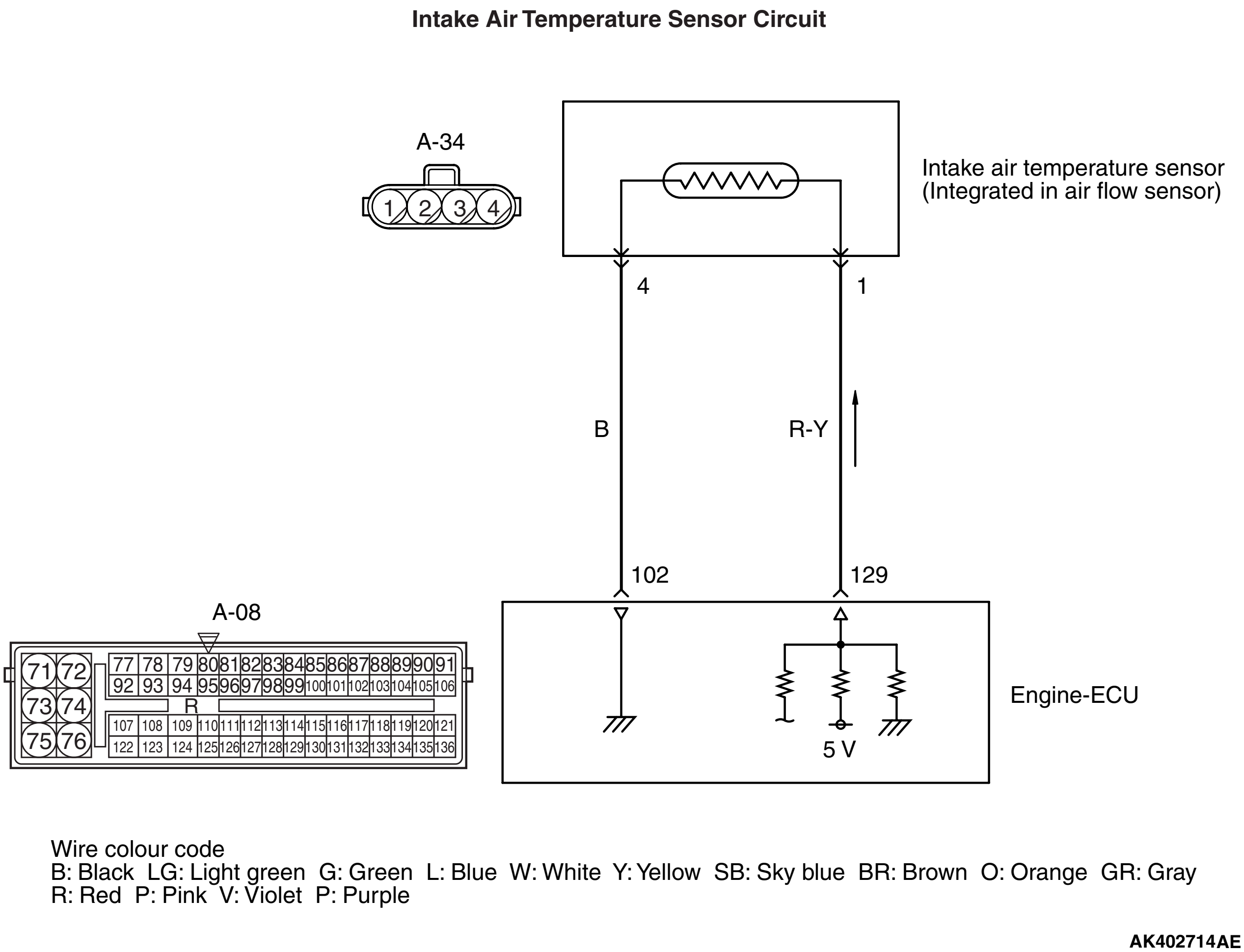
Q: Is the diagnosis code output?

YES : Replace engine-ECU.

NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

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Code No.P0110: Intake Air Temperature Sensor System



OPERATION

- A power voltage of 5 V is applied to the intake air temperature sensor (terminal No. 1) from the engine-ECU (terminal No. 129).
- The intake air temperature sensor (terminal No. 4) is earthed to the engine-ECU (terminal No. 102).

FUNCTION

- The intake air temperature sensor converts the intake air temperature into a voltage signal and inputs the signal to the engine-ECU.
- In response to the signal, the engine-ECU corrects the fuel injection amount, etc.
- The intake air temperature sensor is a kind of resistor, which has the property of decreasing in resistance with the increase of intake air temperature. Therefore, the sensor output voltage varies with the intake air temperature, lowering as the intake air temperature rises.

TROUBLE JUDGEMENT

Check Condition

- 2 seconds later from when ignition switch is in ON position

Or

- 2 seconds later from when engine starts

Judgement Criterion

- Sensor output voltage is more than 4.6 V for 4 seconds. (Intake air temperature is less than -40°C or equivalent.)

Or

- Sensor output voltage is less than 0.2 V for 4 seconds. (Intake air temperature is more than 120°C or equivalent.)

PROBABLE CAUSES

- Failed intake air temperature sensor
- Open/short circuit or damage in intake air temperature sensor circuit or loose connector contact
- Failed engine-ECU

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DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list

- Item 13: Intake air temperature sensor

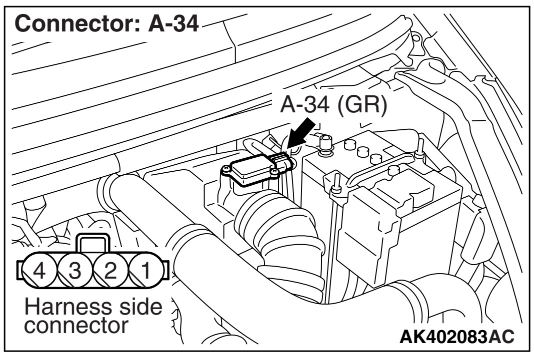
OK: At ambient temperature (atmospheric temperature) or equivalent

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

NO : Go to Step 2 .

STEP 2. Connector check: A-34 air flow sensor connector



Q: Is the check result normal?

YES : Go to Step 3 .

NO : Repair or replace.

STEP 3. Check intake air temperature sensor itself.

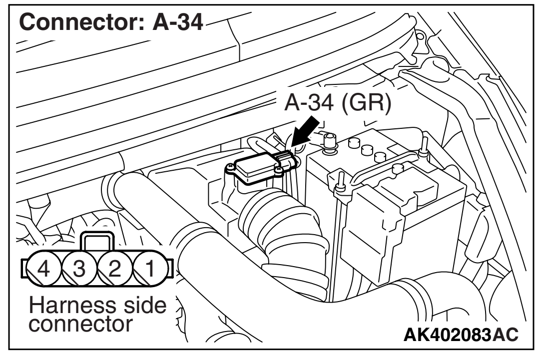
- Check intake air temperature sensor itself (P.13B-364).

Q: Is the check result normal?

YES : Go to Step 4 .

NO : Replace intake air temperature sensor.

STEP 4. Perform resistance measurement at A-34 air flow sensor connector.



- Disconnect connector and measure at harness side.
- Resistance between terminal No. 4 and earth.

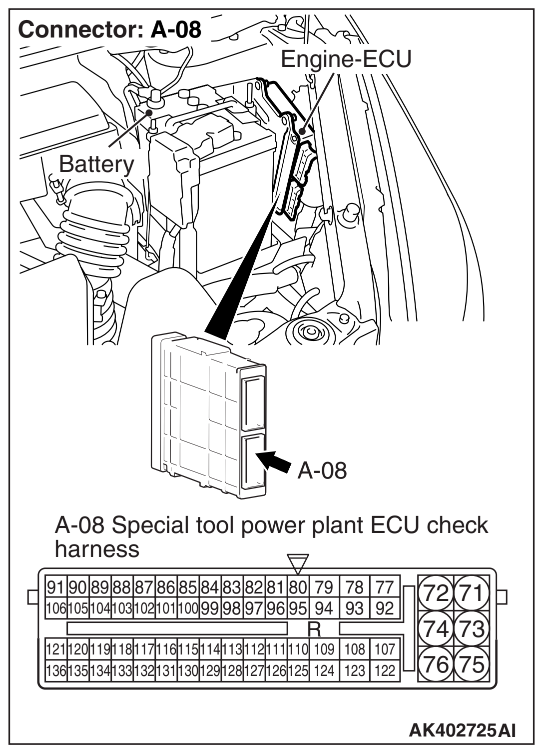
OK: Continuity (2 Ω or less)

Q: Is the check result normal?

YES : Go to Step 8 .

NO : Go to Step 5 .

STEP 5. Connector check: A-08 engine-ECU connector



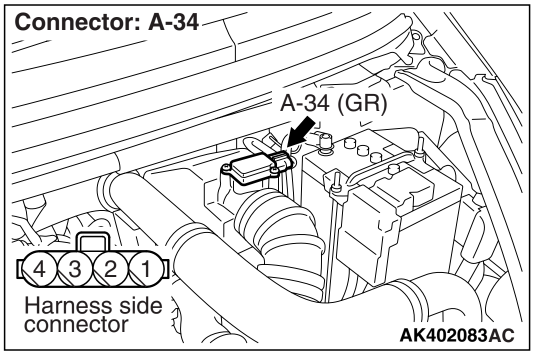
Q: Is the check result normal?

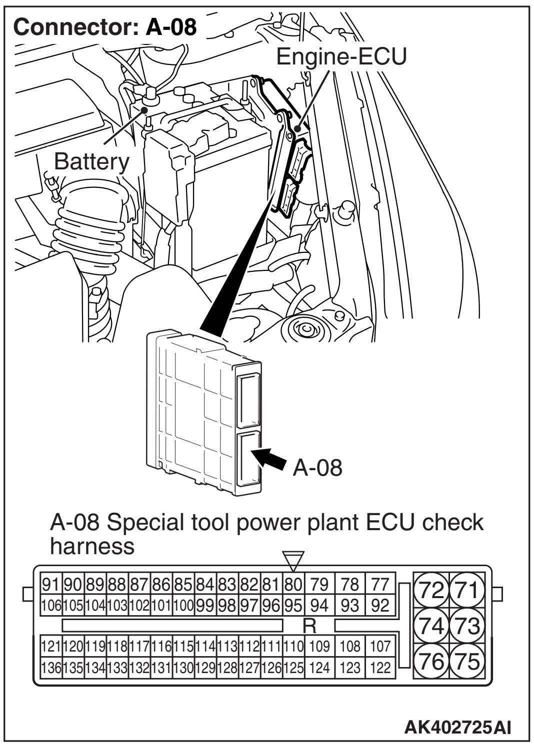
YES : Go to Step 6 .

NO : Repair or replace.

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STEP 6. Check harness between A-34 (terminal No. 4) air flow sensor connector and A-08 (terminal No. 102) engine-ECU connector.





- Check earthing line for open circuit and damage.

Q: Is the check result normal?

YES : Go to Step 7 .
NO : Repair.

STEP 7. M.U.T.-III data list

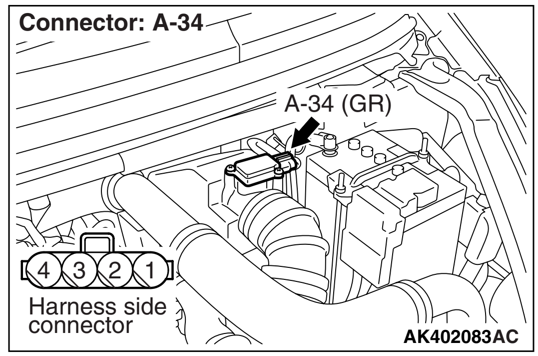
- Item 13: Intake air temperature sensor

OK: At ambient temperature (atmospheric temperature) or equivalent

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).
NO : Replace engine-ECU.

STEP 8. Perform voltage measurement at A-34 air flow sensor connector.



- Disconnect connector and measure at harness side.
- Ignition switch: ON
- Voltage between terminal No. 1 and earth.

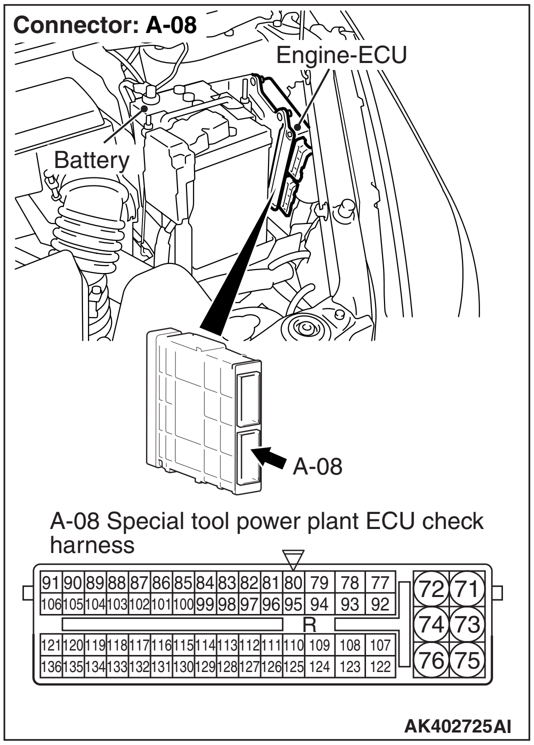
OK: 4.5 – 4.9 V

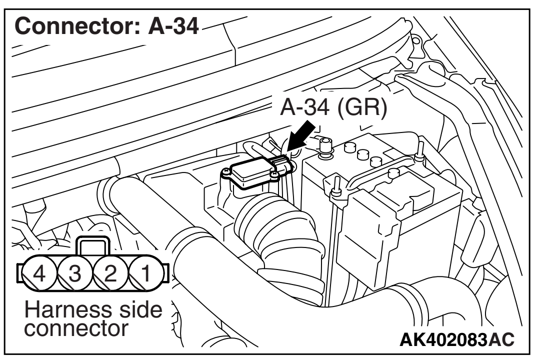
Q: Is the check result normal?

YES : Go to Step 13 .
NO : Go to Step 9 .

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STEP 9. Perform voltage measurement at A-08 engine-ECU connector.





- Disconnect engine-ECU connector, and connect special tool power plant ECU check harness (MB991987) and measure the voltage on the check connector.
- Disconnect A-34 air flow sensor connector.
- Ignition switch: ON
- Voltage between terminal No. 129 and earth.

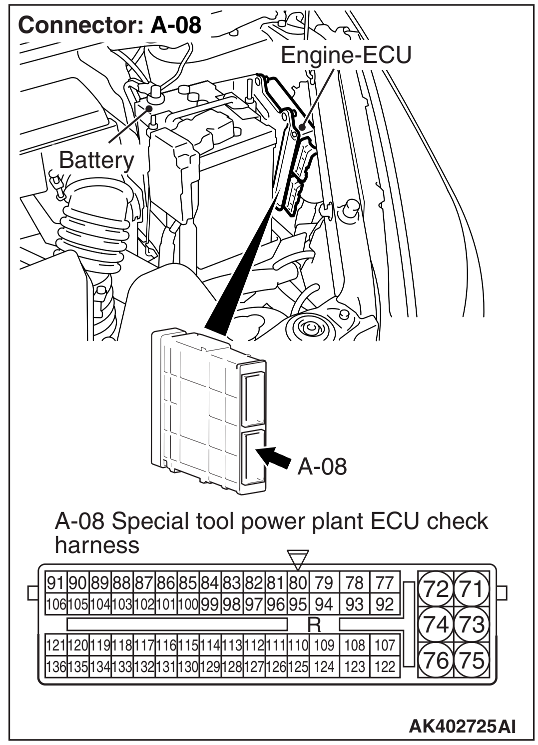
OK: 4.5 – 4.9 V

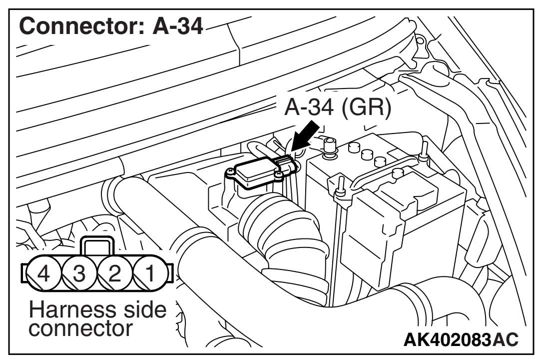
Q: Is the check result normal?

YES : Go to Step 10 .

NO : Go to Step 11 .

STEP 10. Connector check: A-08 engine-ECU connector





Q: Is the check result normal?

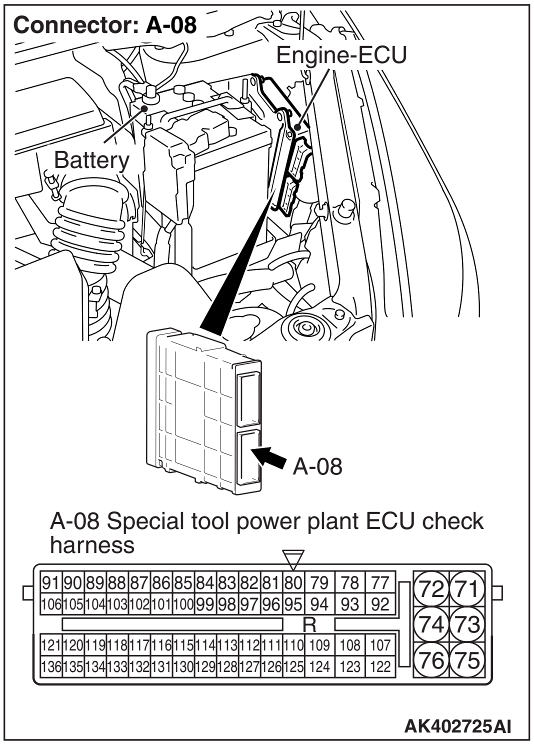
YES : Check and repair harness between A-34 (terminal No. 1) air flow sensor connector and A-08 (terminal No. 129) engine-ECU connector.

- Check output line for open circuit.

NO : Repair or replace.

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STEP 11. Connector check: A-08 engine-ECU connector

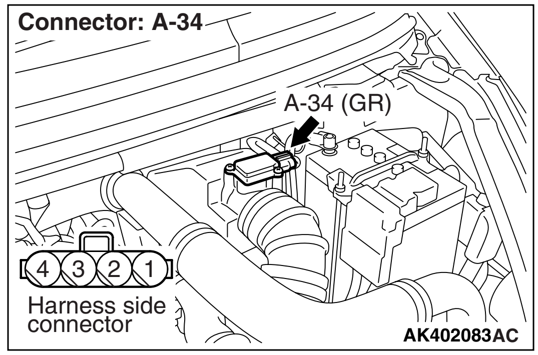


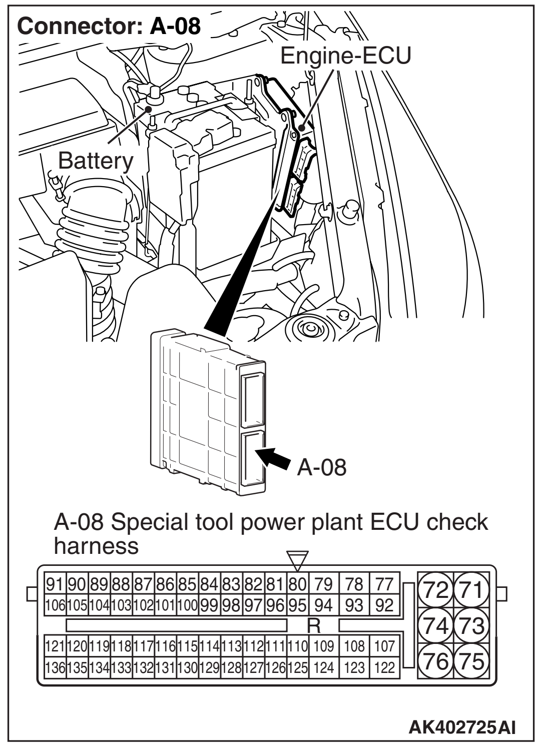
Q: Is the check result normal?

YES : Go to Step 12 .

NO : Repair or replace.

STEP 12. Check harness between A-34 (terminal No. 1) air flow sensor connector and A-08 (terminal No. 129) engine-ECU connector.





- Check output line for short circuit.

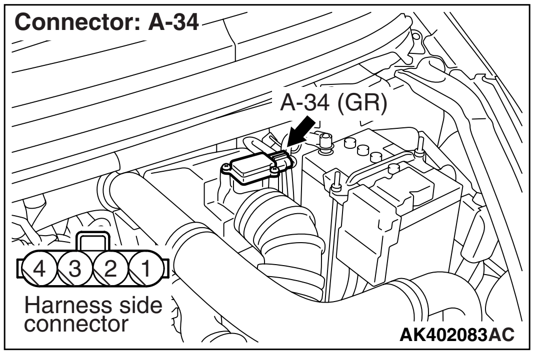
Q: Is the check result normal?

YES : Go to Step 7 .

NO : Repair.

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STEP 13. Perform voltage measurement at A-34 air flow sensor connector.

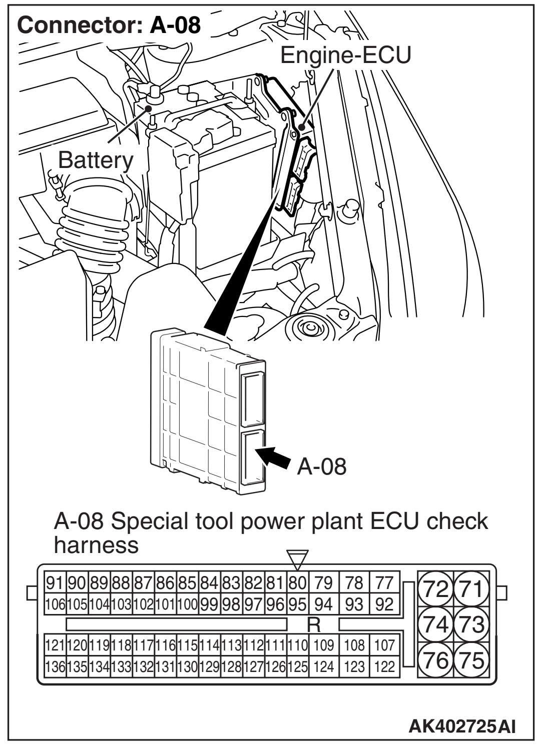


- Use special tool test harness (MB991709) to connect connector only terminal No. 1 and No. 4, and then measure at pick-up harness.
- Ignition switch: ON
- Voltage between terminal No. 1 and earth.

OK:
Ambient temperature at −20°C: 3.8 − 4.4 V
Ambient temperature at 0°C: 3.2 − 3.8 V
Ambient temperature at 20°C: 2.3 − 2.9 V
Ambient temperature at 40°C: 1.5 − 2.1 V
Ambient temperature at 60°C: 0.8 − 1.4 V
Ambient temperature at 80°C: 0.4 − 1.0 V

Q: Is the check result normal?
YES : Go to Step 7 .
NO : Go to Step 14 .

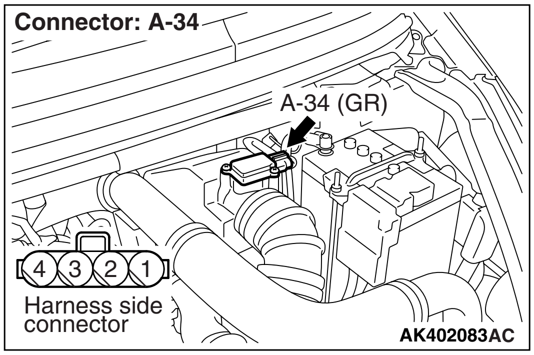
STEP 14. Connector check: A-08 engine-ECU connector

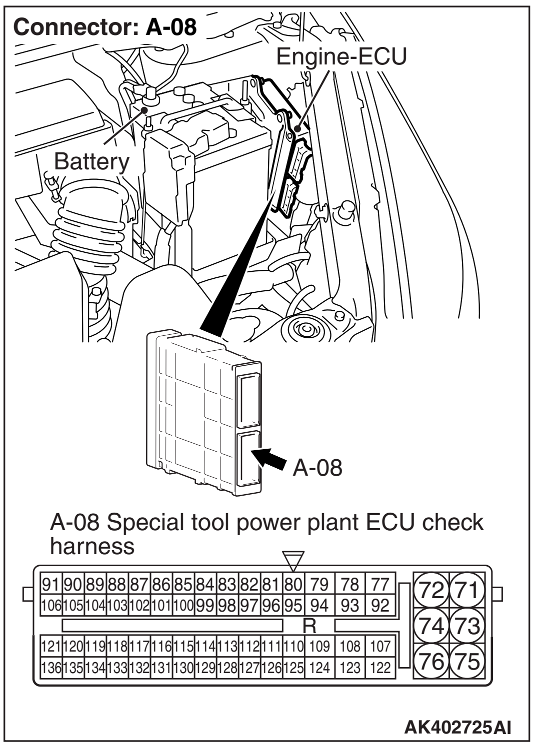


Q: Is the check result normal?
YES : Go to Step 15 .
NO : Repair or replace.

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STEP 15. Check harness between A-34 (terminal No. 1) air flow sensor connector and A-08 (terminal No. 129) engine-ECU connector.





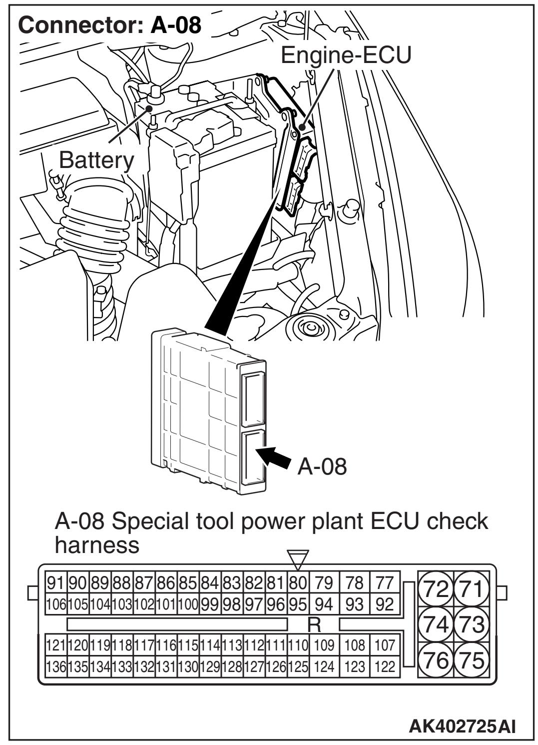
- Check output line for damage.

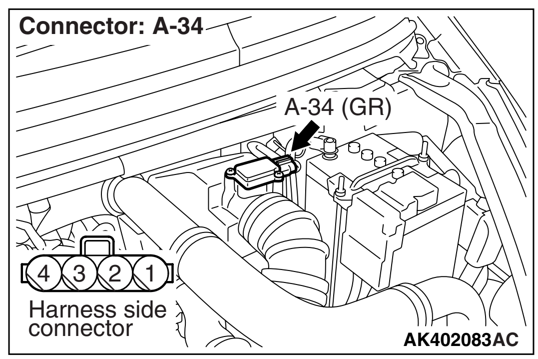
Q: Is the check result normal?

YES : Go to Step 16 .

NO : Repair.

STEP 16. Connector check: A-08 engine-ECU connector





Q: Is the check result normal?

YES : Check harness between A-34 (terminal No. 4) air flow sensor connector and A-08 (terminal No. 102) engine-ECU connector.

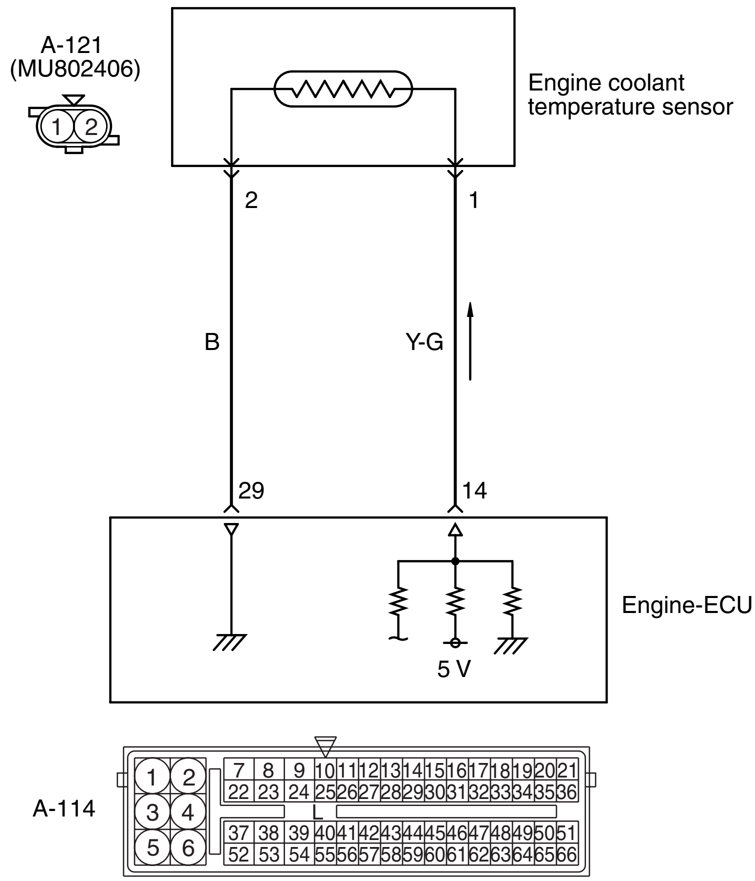
- Check earthing line for damage.

NO : Repair or replace.

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Code No. P0115: Engine Coolant Temperature Sensor System

Engine Coolant Temperature Sensor Circuit



Wire colour code
B: Black LG: Light green G: Green L: Blue W: White Y: Yellow SB: Sky blue BR: Brown O: Orange GR: Gray
R: Red P: Pink V: Violet P: Purple

AK402678AF

OPERATION

- A power voltage of 5 V is applied to the engine coolant temperature sensor output terminal (terminal No. 1) from the engine-ECU (terminal No. 14).
- The engine coolant temperature sensor (terminal No. 2) is earthed to the engine-ECU (terminal No. 29).

FUNCTION

- The engine coolant temperature sensor converts the engine coolant temperature into a voltage signal and inputs the signal to the engine-ECU.
- In response to the signal, the engine-ECU controls the fuel injection amount and fast idle speed when the engine is cold.
- The engine coolant temperature sensor is a kind of resistor, which has the property of decreasing in resistance with the increase of engine coolant temperature. Therefore, the sensor output voltage varies with the engine coolant temperature, lowering as the engine coolant temperature rises.

TROUBLE JUDGEMENT

Check Condition

- 2 seconds later from when ignition switch is in ON position

or

- 2 seconds later from when engine starts

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Judgement Criterion

- Sensor output voltage is more than 4.6 V for 4 seconds. (Intake air temperature is less than -40°C or equivalent.)

or

- Sensor output voltage is less than 0.1 V for 4 seconds. (Intake air temperature is more than 120°C or equivalent.)

Check Condition

- While engine is running

Judgement Criterion

- Engine coolant sensor output voltage rises to more than 1.6 V from less than 1.6 V. (Engine coolant temperature decreases to less than 40°C or equivalent from more than 40°C or equivalent.)
- Then, for 5 minutes, engine coolant temperature output voltage is more than 1.6 V. (Engine coolant temperature is less than 40°C or equivalent.)

PROBABLE CAUSES

- Failed engine coolant temperature sensor
- Open/short circuit or damage in engine coolant temperature sensor circuit, or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

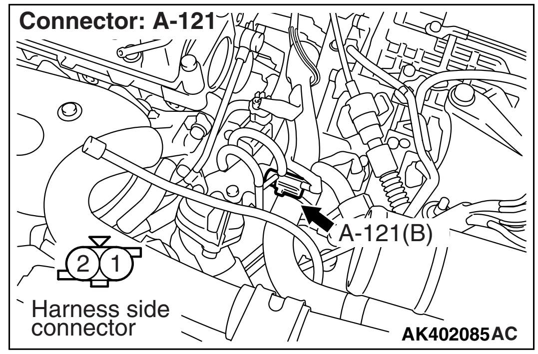
STEP 1. M.U.T.-III data list

- Item 21: Engine coolant temperature sensor

OK:
When the engine is cold: Nearly equal to ambient temperature (atmospheric temperature)
When the engine is hot: 80 – 120°C

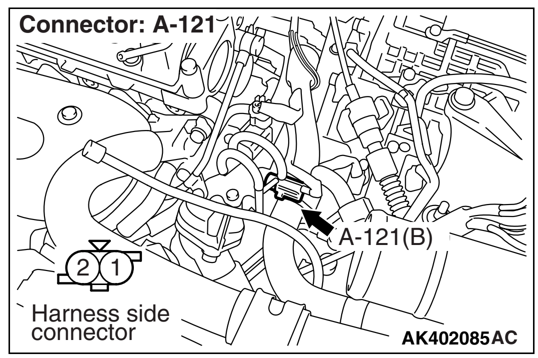
Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points –How to Cope with Intermittent Malfunctions P.00-13).
NO : Go to Step 2 .

STEP 2. Connector check: A-121 engine coolant temperature sensor connector



Q: Is the check result normal?
YES : Go to Step 3 .
NO : Repair or replace.

STEP 3. Perform resistance measurement at A-121 engine coolant temperature sensor connector.



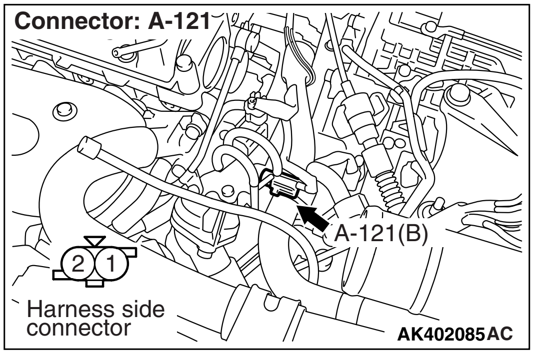
- Disconnect connector and measure at sensor side.
- Resistance between terminals No. 1 and No. 2

OK:
Engine coolant temperature at –20°C: 14 – 17 kΩ
Engine coolant temperature at 0°C: 5.1 – 6.5 kΩ
Engine coolant temperature at 20°C: 2.1 – 2.7 kΩ
Engine coolant temperature at 40°C: 0.9 – 1.3 kΩ
Engine coolant temperature at 60°C: 0.48 – 0.68 kΩ
Engine coolant temperature at 80°C: 0.26 – 0.36 kΩ

Q: Is the check result normal?
YES : Go to Step 4 .
NO : Replace engine coolant temperature sensor.

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STEP 4. Perform voltage measurement at A-121 engine coolant temperature sensor connector.



- Disconnect connector and measure at harness side.
- Ignition switch: ON
- Voltage between terminal No. 1 and earth.

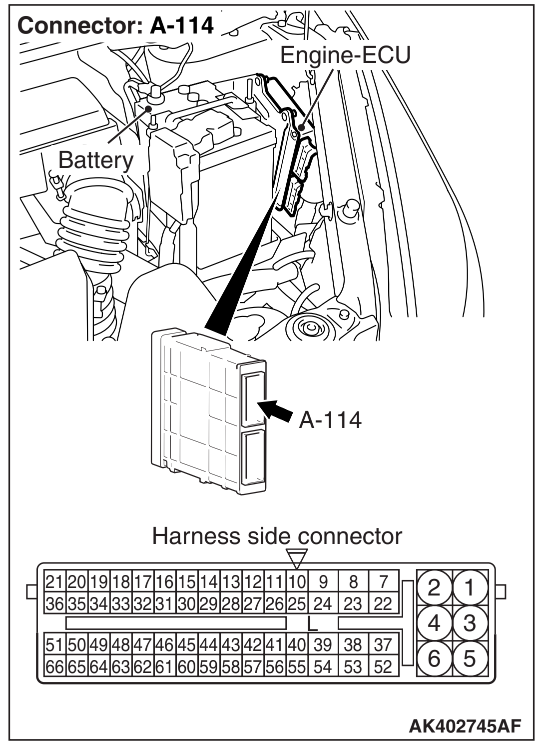
OK: 4.5 – 4.9 V

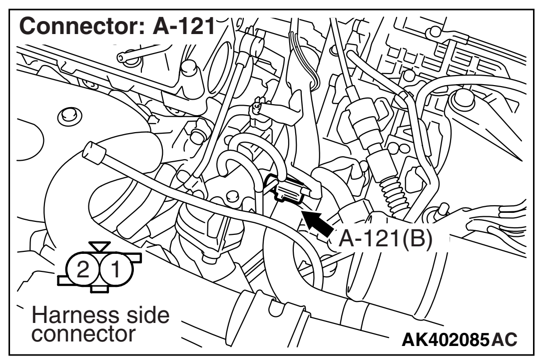
Q: Is the check result normal?

YES : Go to Step 10 .

NO : Go to Step 5 .

STEP 5. Perform voltage measurement at A-114 engine-ECU connector.





- Disconnect engine-ECU connector, and connect special tool power plant ECU check harness (MB991987) and measure the voltage on the check connector.
- Disconnect A-121 engine coolant temperature sensor connector.
- Ignition switch: ON
- Voltage between terminal No. 14 and earth.

OK: 4.5 – 4.9 V

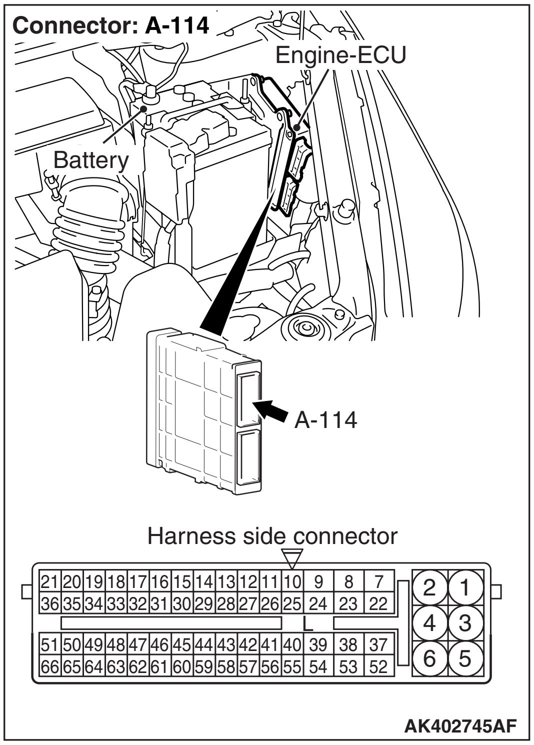
Q: Is the check result normal?

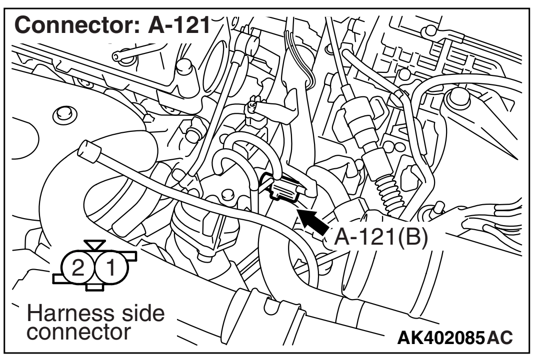
YES : Go to Step 6 .

NO : Go to Step 7 .

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STEP 6. Connector check: A-114 engine-ECU connector





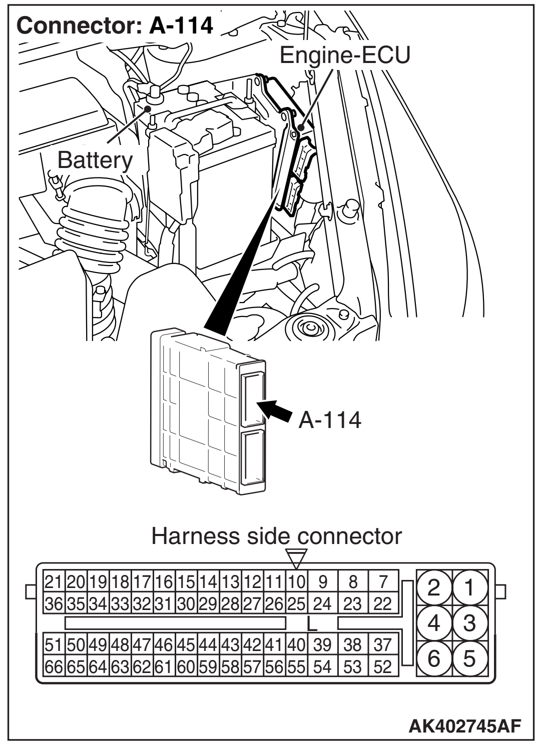
Q: Is the check result normal?

YES : Check and repair harness between A-121 (terminal No. 1) engine coolant temperature sensor connector and A-114 (terminal No. 14) engine-ECU connector .

- Check output line for open circuit.

NO : Repair or replace.

STEP 7. Connector check: A-114 engine-ECU connector



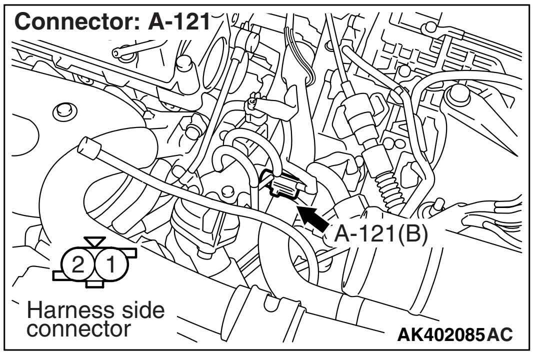
Q: Is the check result normal?

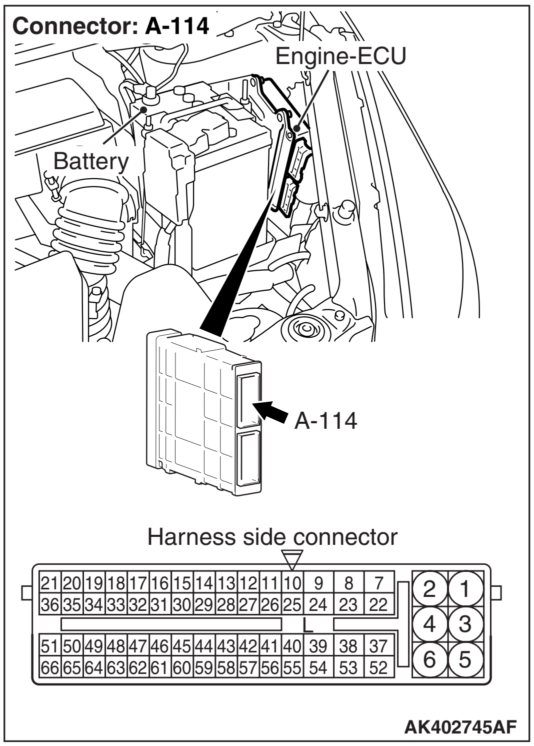
YES : Go to Step 8 .

NO : Repair or replace.

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STEP 8. Check harness between A-121 (terminal No. 1) engine coolant temperature sensor connector and A-114 (terminal No. 14) engine-ECU connector.





- Check output line for open circuit.

Q: Is the check result normal?

YES : Go to Step 9 .

NO : Repair.

STEP 9. M.U.T.-III data list

- Item 21: Engine coolant temperature sensor

OK:

When the engine is cold: Nearly equal to ambient temperature (atmospheric temperature)

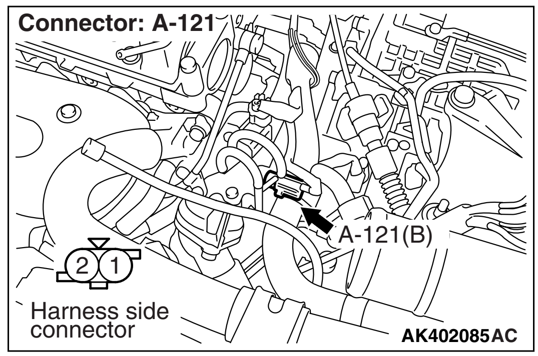
When the engine is hot: 80 – 120°C

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

NO : Replace engine-ECU.

STEP 10. Perform resistance measurement at A-121 engine coolant temperature sensor connector.



- Disconnect connector and measure at harness side.
- Resistance between terminal No. 2 and earth.

OK: Continuity (2 Ω or less)

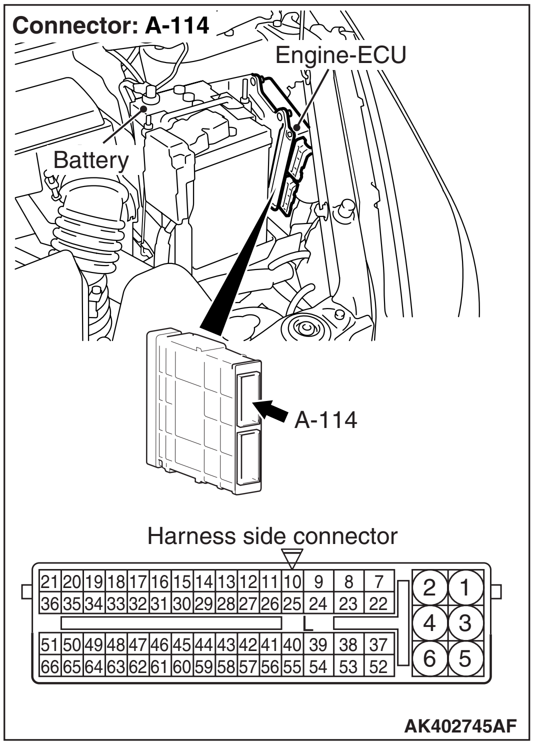
Q: Is the check result normal?

YES : Go to Step 13 .

NO : Go to Step 11 .

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STEP 11. Connector check: A-114 engine-ECU connector

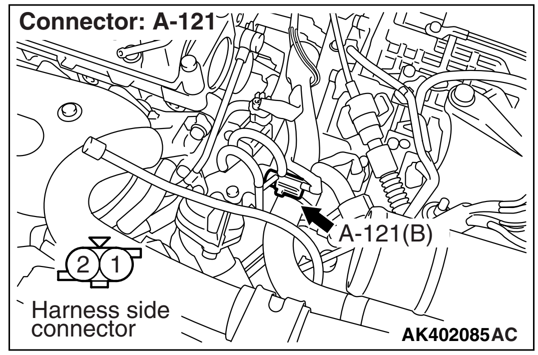


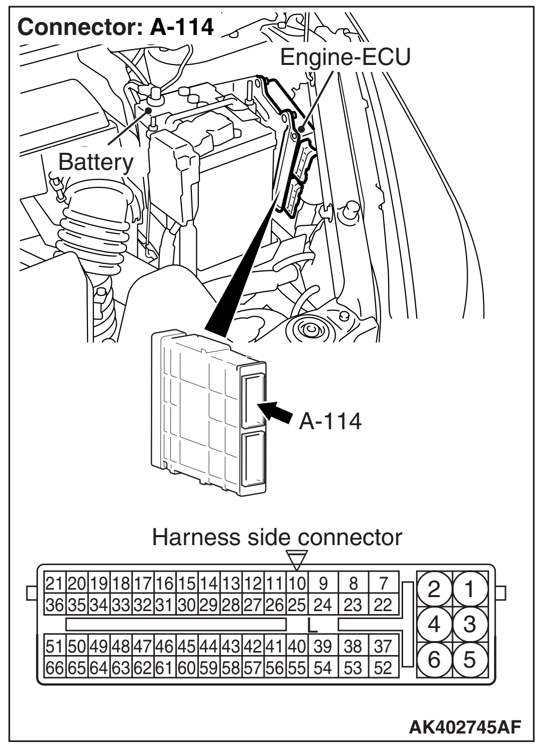
Q: Is the check result normal?

YES : Go to Step 12 .

NO : Repair or replace.

STEP 12. Check harness between A-121 (terminal No. 2) engine coolant temperature sensor connector and A-114 (terminal No. 29) engine-ECU connector.





- Check earthing line for open circuit and damage

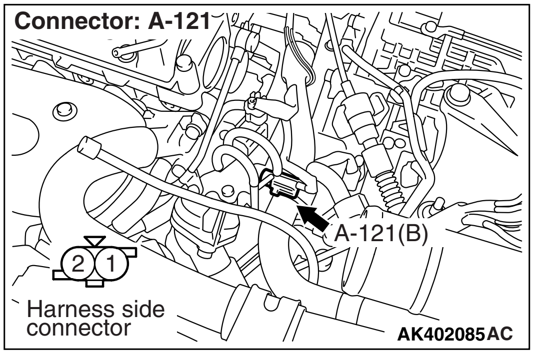
Q: Is the check result normal?

YES : Go to Step 9 .

NO : Repair.

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STEP 13. Perform voltage measurement at A-121 engine coolant temperature sensor connector.

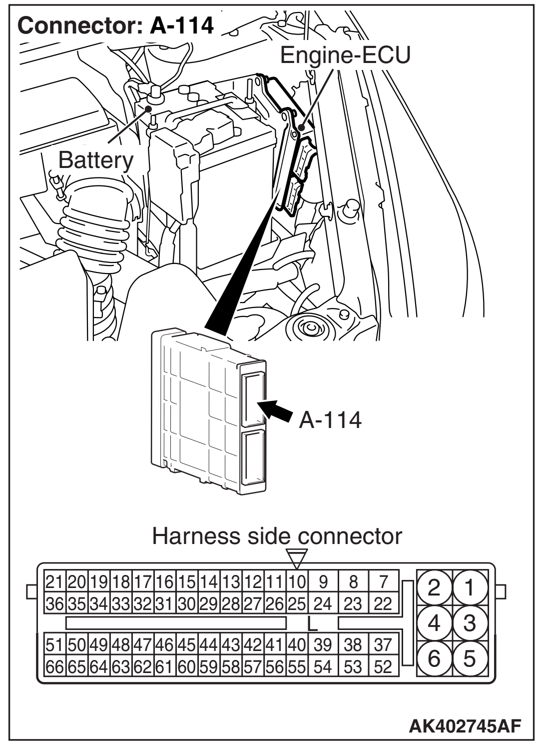


- Use special tool test harness (MB991658) to connect connector, and measure voltage at pick-up harness.
- Ignition switch: ON
- Voltage between terminal No.1 and earth.

OK:
Engine coolant temperature at –20°C: 3.9 – 4.5 V
Engine coolant temperature at 0°C: 3.2 – 3.8 V
Engine coolant temperature at 20°C: 2.3 – 2.9 V
Engine coolant temperature at 40°C: 1.3 – 1.9 V
Engine coolant temperature at 60°C: 0.7 – 1.3 V
Engine coolant temperature at 80°C: 0.3 – 0.9 V

Q: Is the check result normal?
YES : Go to Step 9 .
NO : Go to Step 14 .

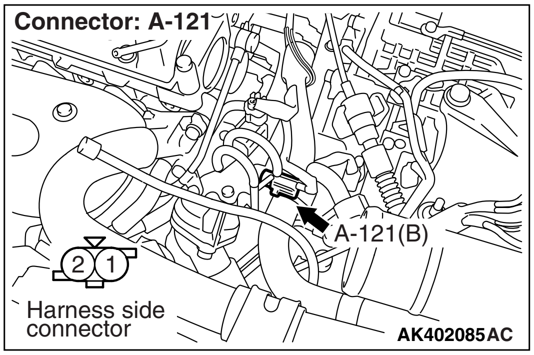
STEP 14. Connector check: A-114 engine-ECU connector

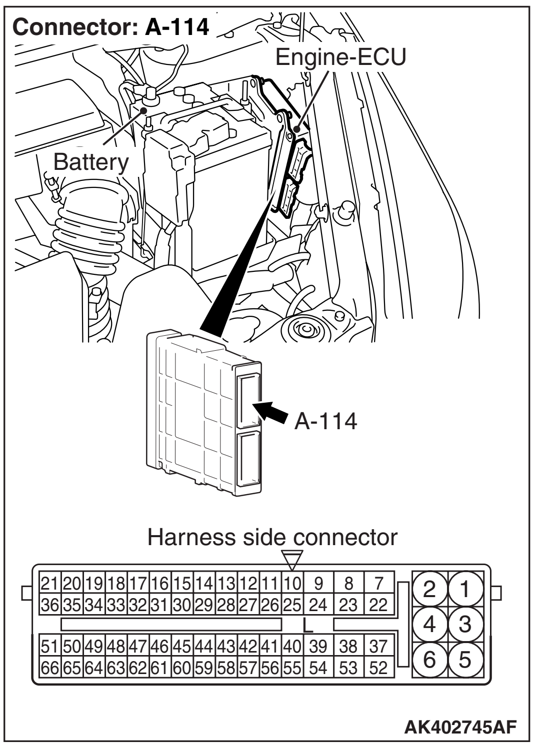


Q: Is the check result normal?
YES : Go to Step 15 .
NO : Repair or replace.

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STEP 15. Check harness between A-121 (terminal No. 1) engine coolant temperature sensor connector and A-114 (terminal No. 14) engine-ECU connector.





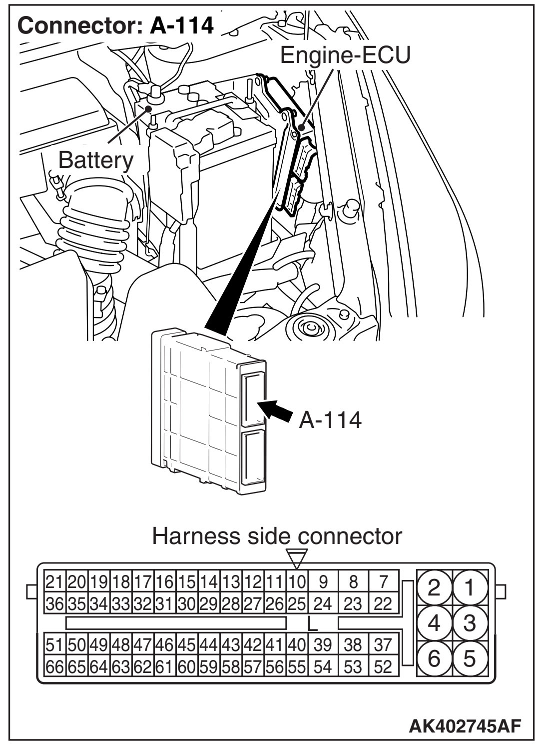
- Check output line for damage.

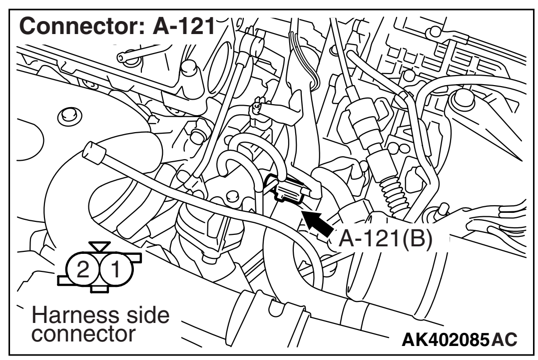
Q: Is the check result normal?

YES : Go to Step 16 .

NO : Repair.

STEP 16. Connector check: A-114 engine-ECU connector





Q: Is the check result normal?

YES : Check and repair harness between A-121 (terminal No. 2) engine coolant temperature sensor connector and A-114 (terminal No. 29) engine-ECU connector.

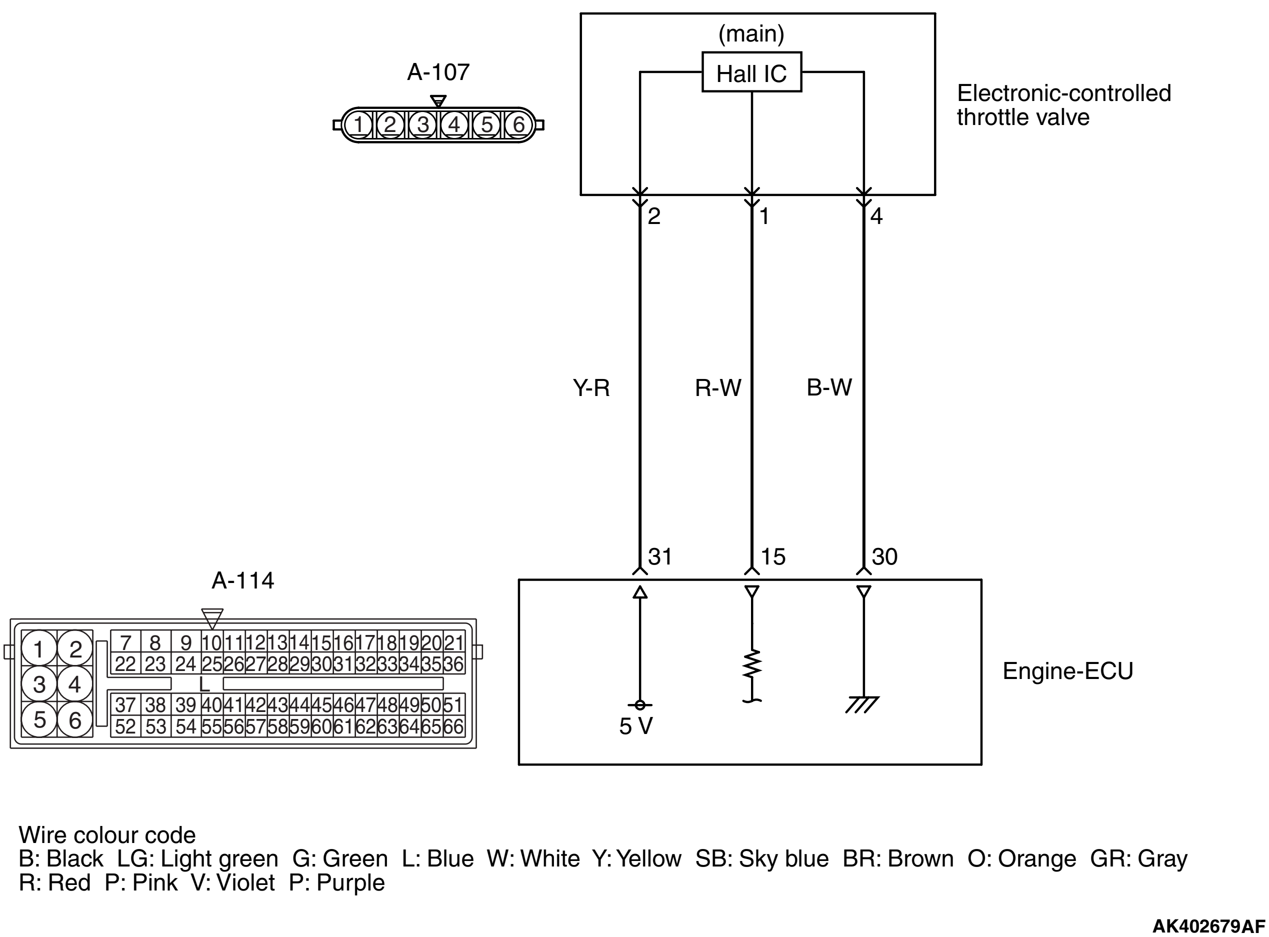
- Check earthing line for damage.

NO : Repair or replace.

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Code No. P0122: Throttle Position Sensor (Main) Circuit Low Input

Throttle Position Sensor (main) Circuit



OPERATION

- A power voltage of 5 V is applied to the electronic-controlled throttle valve (terminal No. 2) from the engine-ECU (terminal No. 31).
- The power voltage is earthed to the engine-ECU (terminal No. 30) from the electronic-controlled throttle valve (terminal No. 4).
- The sensor signal is inputted to the engine-ECU (terminal No. 15) from the electronic-controlled throttle valve output terminal (terminal No. 1).

FUNCTION

- The throttle position sensor converts the throttle valve position into voltage and inputs it into the engine-ECU.
- The engine-ECU controls the throttle valve position.

TROUBLE JUDGMENT

Check Condition

- Ignition switch is in "ON" position.

Judgment Criterion

- Throttle position sensor (main) output voltage is less than 0.2 V.

PROBABLE CAUSES

- Failed throttle position sensor (main)
- Open/short circuit and damage in throttle position sensor circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list

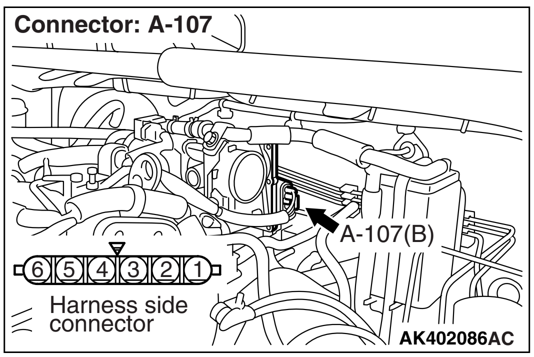
- Refer to Data List Reference Table P.13B-335.
  a. Item No. 79: Throttle position sensor (main)

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

NO : Go to Step 2 .

STEP 2. Connector check: A-107 electronic-controlled throttle valve connector

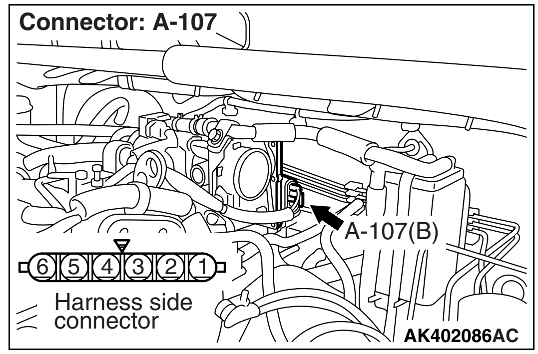


Q: Is the check result normal?

YES : Go to Step 3 .

NO : Repair or replace the connector.

STEP 3. Perform voltage measurement at A-107 electronic-controlled throttle valve connector.



- Disconnect connector, and measure at harness side.
- Ignition switch: ON
- Voltage between terminal No. 2 and earth.

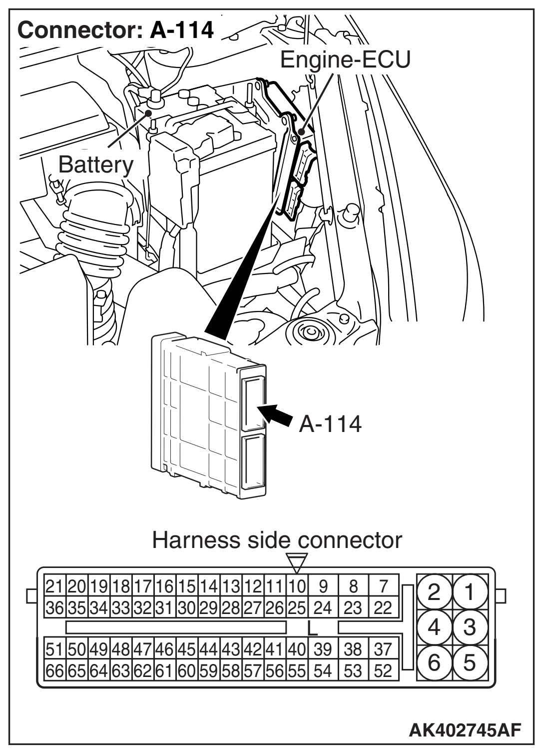
OK: 4.9 – 5.1 V

Q: Is the check result normal?

YES : Go to Step 7 .

NO : Go to Step 4 .

STEP 4. Connector check: A-114 engine-ECU connector



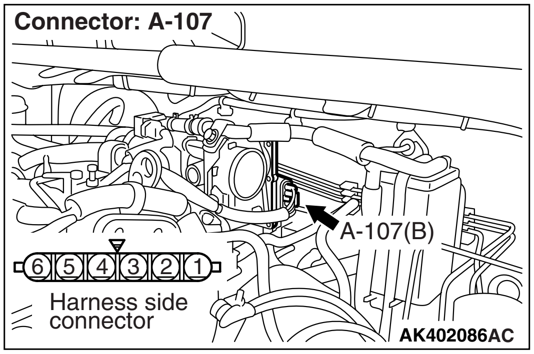
Q: Is the check result normal?

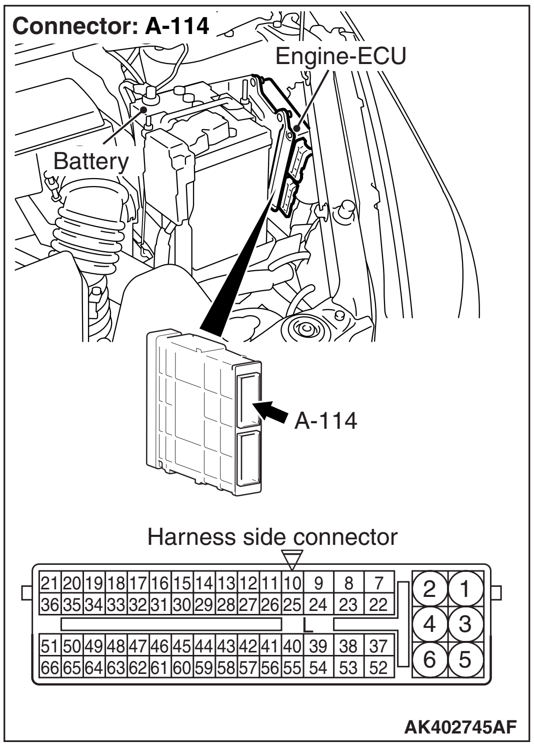
YES : Go to Step 5 .

NO : Repair or replace the connector.

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STEP 5. Check harness between A-107 (terminal No. 2) electronic-controlled throttle valve connector and A-114 (terminal No. 31) engine-ECU connector.





- Check power supply line for open/short circuit.

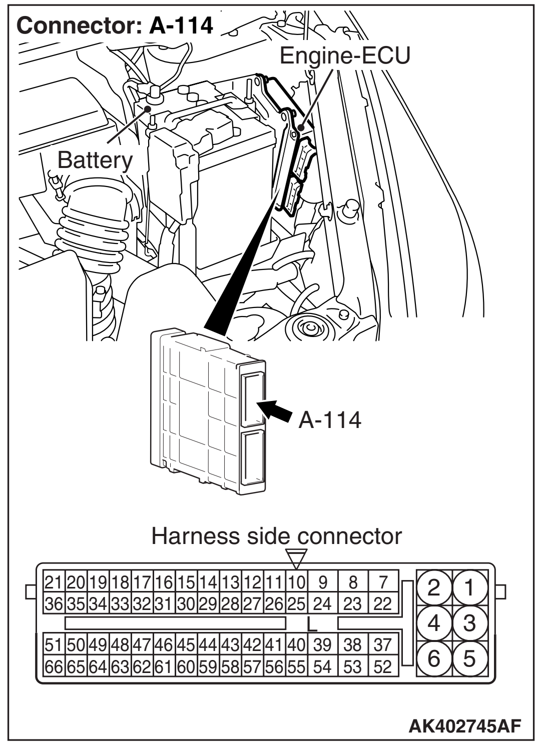
Q: Is the check result normal?
YES : Go to Step 6 .
NO : Repair the damaged harness wire.

STEP 6. M.U.T.-III data list

- Refer to Data List Reference Table P.13B-335.
  a. Item No. 79: Throttle position sensor (main)

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).
NO : Replace engine-ECU.

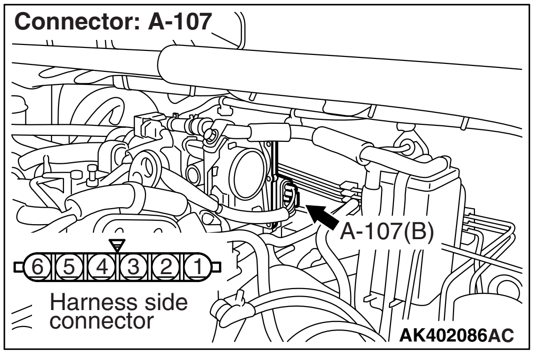
STEP 7. Connector check: A-114 engine-ECU connector

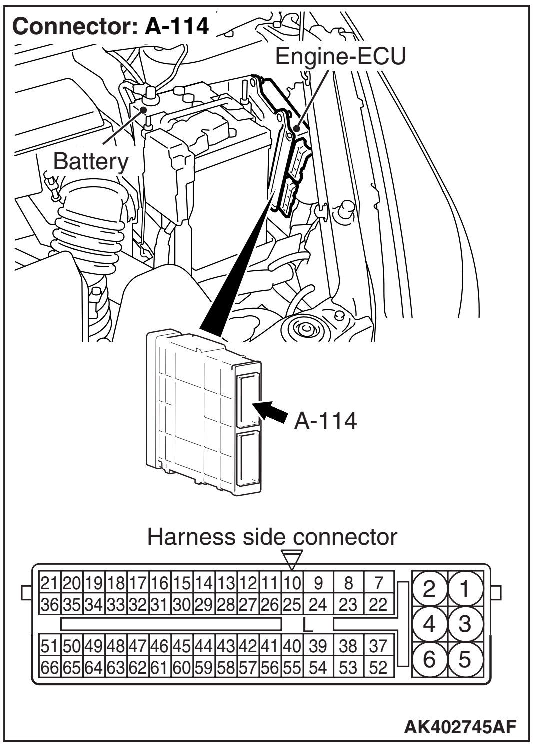


Q: Is the check result normal?
YES : Go to Step 8 .
NO : Repair or replace the connector.

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STEP 8. Check harness between A-107 (terminal No. 2) electronic-controlled throttle valve connector and A-114 (terminal No. 31) engine-ECU connector.





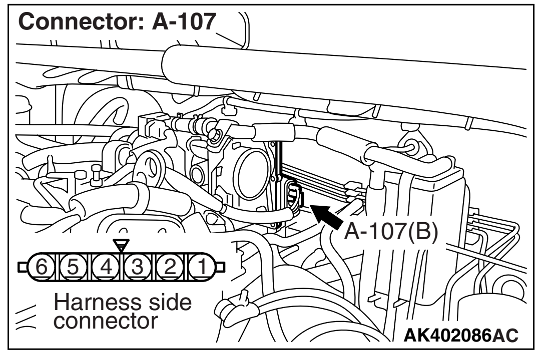
- Check power supply line for damage.

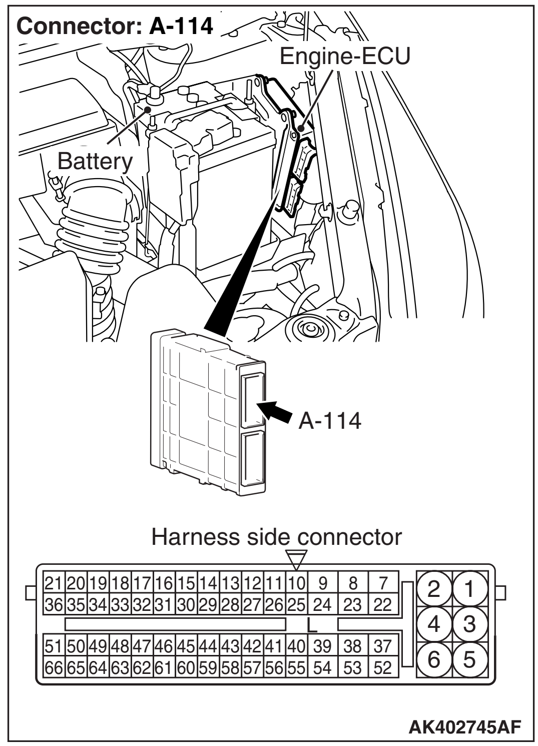
Q: Is the check result normal?

YES : Go to Step 9 .

NO : Repair the damaged harness wire.

STEP 9. Check harness between A-107 (terminal No. 1) electronic-controlled throttle valve connector and A-114 (terminal No. 15) engine-ECU connector.





- Check output line for open/short circuit and damage.

Q: Is the check result normal?

YES : Go to Step 10 .

NO : Repair the damaged harness wire.

STEP 10. Replace the throttle body assembly

- After replacing the throttle body assembly re-check the trouble symptoms.

Q: Is the check result normal?

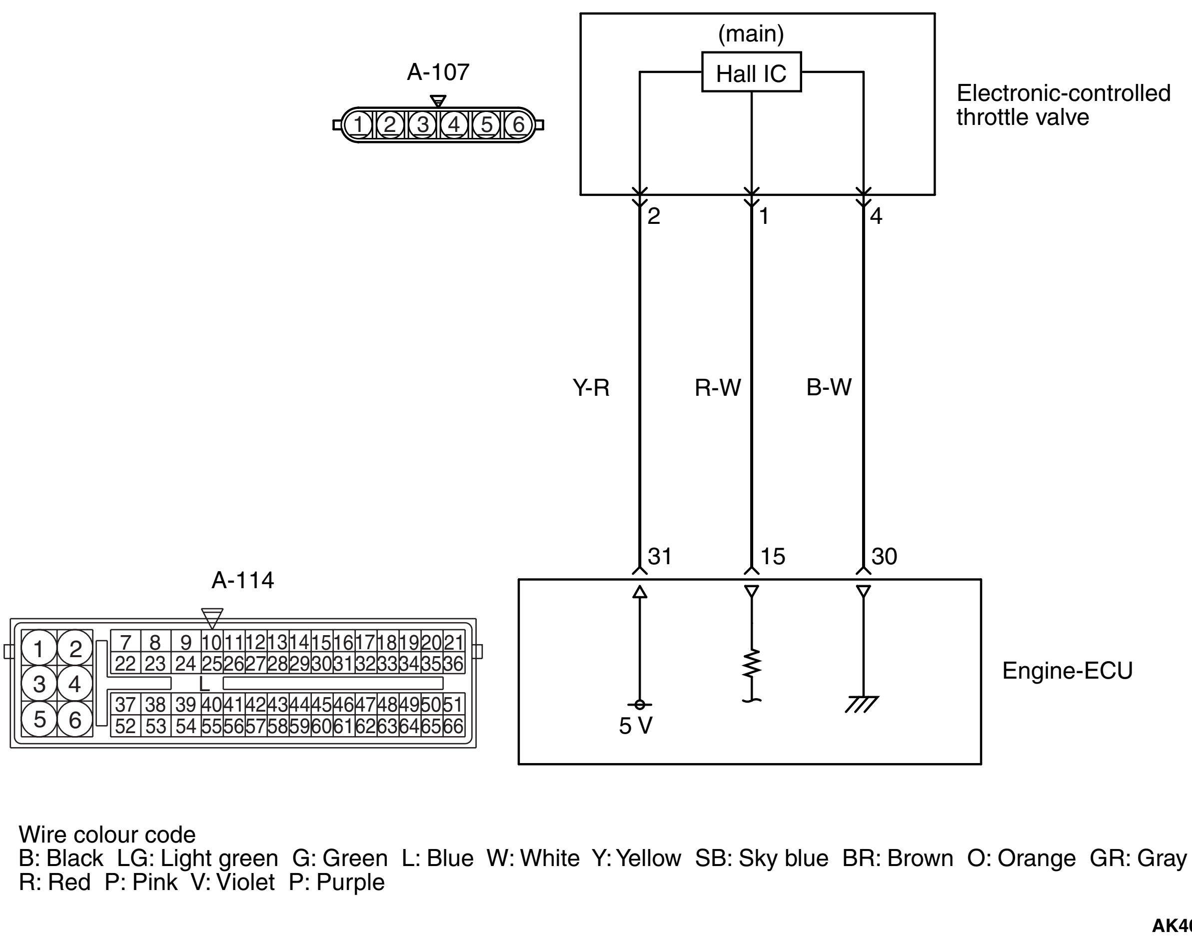
YES : Check end.

NO : Replace engine-ECU.

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Code No. P0123: Throttle Position Sensor (Main) Circuit High Input

Throttle Position Sensor (main) Circuit



OPERATION

- A power voltage of 5 V is applied to the electronic-controlled throttle valve (terminal No. 2) from the engine-ECU (terminal No. 31).
- The power voltage is earthed to the engine-ECU (terminal No. 30) from the electronic-controlled throttle valve (terminal No. 4).
- The sensor signal is inputted to the engine-ECU (terminal No. 15) from the electronic-controlled throttle valve output terminal (terminal No. 1).

FUNCTION

- The throttle position sensor converts the throttle valve position into voltage and inputs it into the engine-ECU.
- The engine-ECU controls the throttle valve position.

TROUBLE JUDGMENT

Check Condition

- Ignition switch is in "ON" position.

Judgment Criterion

- Throttle position sensor (main) output voltage is more than 4.8 V.

PROBABLE CAUSES

- Failed throttle position sensor (main)
- Open/short circuit and damage in throttle position sensor circuit or loose connector contact
- Failed engine-ECU

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DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list

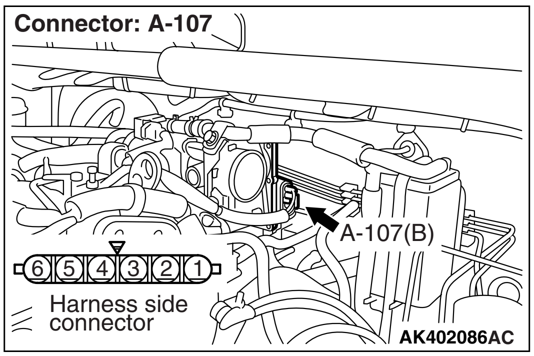
- Refer to Data List Reference Table P.13B-335.
  a. Item No. 79: Throttle position sensor (main)

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

NO : Go to Step 2 .

STEP 2. Connector check: A-107 electronic-controlled throttle valve connector

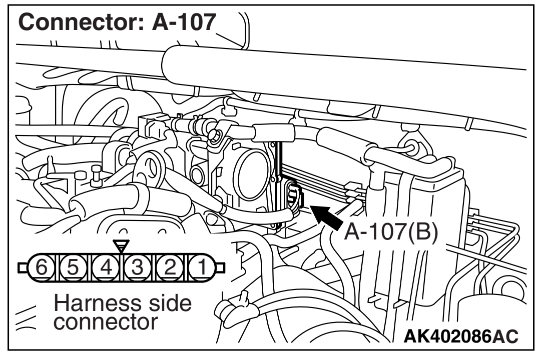


Q: Is the check result normal?

YES : Go to Step 3 .

NO : Repair or replace the connector.

STEP 3. Perform resistance measurement at A-107 electronic-controlled throttle valve connector.



- Disconnect connector, and measure at harness side.
- Resistance between terminal No. 4 and earth.

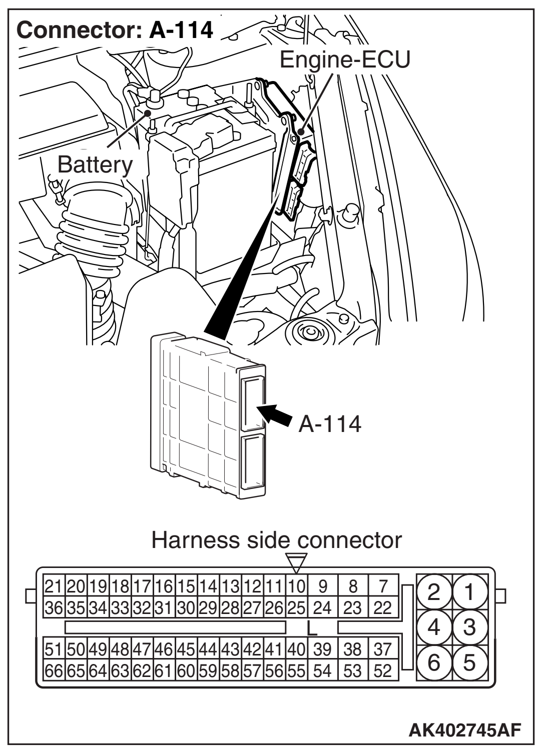
OK: Continuity (2 Ω or less)

Q: Is the check result normal?

YES : Go to Step 7 .

NO : Go to Step 4 .

STEP 4. Connector check: A-114 engine-ECU connector

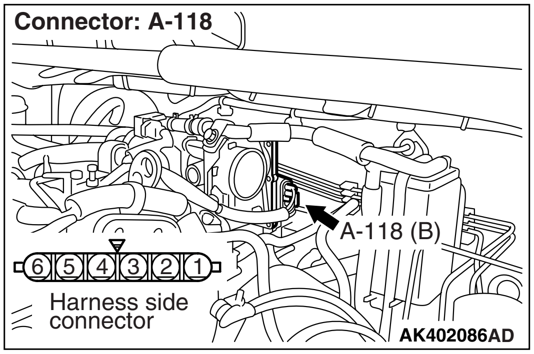


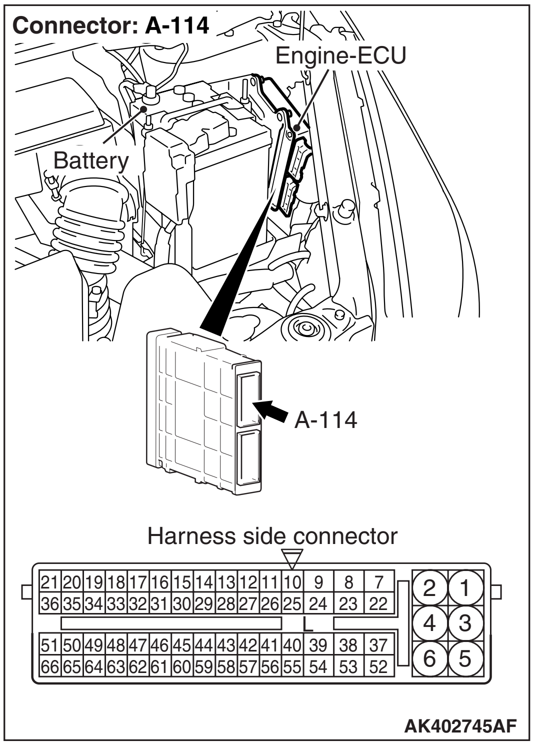
Q: Is the check result normal?

YES : Go to Step 5 .

NO : Repair or replace the connector.

STEP 5. Check harness between A-107 (terminal No. 4) electronic-controlled throttle valve connector and A-114 (terminal No. 30) engine-ECU connector





- Check earthing line for open circuit and damage.

Q: Is the check result normal?

YES : Go to Step 6 .

NO : Repair the damaged harness wire.

STEP 6. M.U.T.-III data list

- Refer to Data List Reference Table P.13B-335.
  a. Item No. 79: Throttle position sensor (main)

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 - How to Use Troubleshooting/Inspection Service Points - How to Cope with Intermittent Malfunctions P.00-13).

NO : Replace engine-ECU.

STEP 7. Replace the throttle body assembly

- After replacing the throttle body assembly, re-check the trouble symptoms.

Q: Is the check result normal?

YES : Check end.

NO : Replace engine-ECU.

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Code No. P0125: Feedback System Monitor

OPERATION

- Refer to Code No. P0201 No. 1 Injector System P.13B-92.

Refer to Code No. P0202 No. 2 Injector System P.13B-97.

Refer to Code No. P0203 No. 3 Injector System P.13B-102.

Refer to Code No. P0204 No. 4 Injector System P.13B-107.

- Refer to Code No. P0130 Oxygen Sensor (Front) Circuit P.13B-65.

FUNCTION

- The engine-ECU effects air-fuel ratio feedback control in accordance with the signals from the oxygen sensor (front).
- If the oxygen sensor (front) has deteriorated, corrections will be made by the oxygen sensor (rear).
- Diagnosis code P0125 becomes stored in memory if a failure is detected in the above air/fuel ratio feedback control system.

TROUBLE JUDGMENT

Check Conditions

- 30 seconds later from when engine starts.
- Engine coolant temperature is more than 82°C.
- Not in low speed operation.
- Within the range of air-fuel ratio feed back operation.

Judgment Criterion

- The oxygen sensor (front) output voltage is not deviated from 0.5 V for 30 seconds.

PROBABLE CAUSES

- Failed oxygen sensor (front)
- Harness damage in oxygen sensor (front) circuit or loose connector contact
- Failed oxygen sensor (rear)

NOTE: When the oxygen sensor (front) begins to deteriorate, the oxygen sensor output voltage will deviate from the voltage when the sensor was new (normally 0.5 volt at stoichiometric ratio). This deviation will be corrected by the oxygen sensor (rear).If the oxygen sensor (rear) responds poorly because it has deteriorated, it will improperly correct the oxygen sensor (front). Thus, even when closed loop control is being effected, the fluctuation of the oxygen sensor (front) output voltage decreases, without intersecting with 0.5 volt. As a result, there is a possibility of diagnosis code P0125 becoming registered.

- Failed fuel system
- Failed exhaust system
- Air drawn in from gaps in gasket, seals, etc
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

Q: Is any other diagnosis code than P0125 output?

YES : Inspection chart for diagnosis code (Refer to P.13B-18).

NO : Go to Step 2 .

STEP 2. M.U.T.-III data list

- Refer to Data List Reference Table P.13B-335.

a. Item No. 21: Engine coolant temperature sensor

b. Item No. 11: Oxygen sensor (front)

c. Item No. 59: Oxygen sensor (rear)

d. Item No. 12: Air flow sensor

Q: Are the check results normal?

YES : Go to Step 3 .

NO : Perform the diagnosis code classified check procedure for the sensor that has shown an abnormal data valve (Refer to Inspection Chart for Diagnosis Code P.13B-18).

STEP 3. M.U.T.-III data list

- Refer to Data List Reference Table P.13B-335.

a. Item No. 25: Barometric pressure sensor

Q: Is the check result normal?

YES : Go to Step 4 .

NO : Replace engine-ECU.

STEP 4. Check for intake of air from gaps in gasket, seals, etc.

Q: Is the check result normal?

YES : Go to Step 5 .

NO : Repair for intake of air from gaps in gasket, seals, etc.

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STEP 5. Check for leakage of exhaust emission from exhaust manifold.

Q: Is the check result normal?

YES : Go to Step 6 .

NO : Repair for leakage of exhaust emission from exhaust manifold.

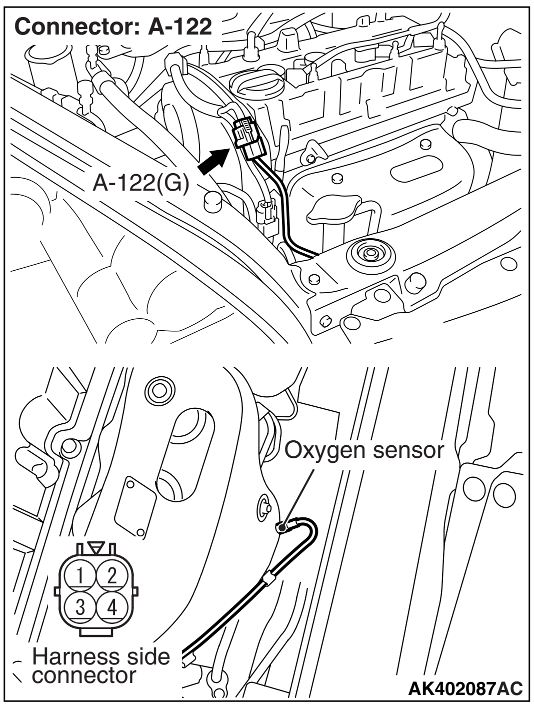
STEP 6. Check throttle body (throttle valve portion) for contamination.

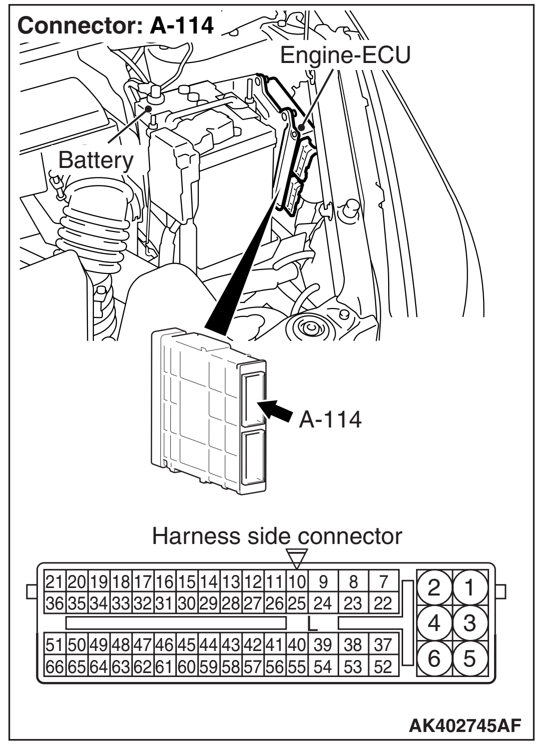
Q: Is the check result normal?

YES : Go to Step 7 .

NO : Clean throttle body (throttle valve portion) (Refer to P.13B-358).

STEP 7. Connector check: A-122 oxygen sensor (front) connector, A-114 engine-ECU connector.





Q: Is the check result normal?

YES : Go to Step 8 .

NO : Repair or replace the connector.

STEP 8. Check A-122 oxygen sensor (front) itself.

- Check oxygen sensor (front) itself (Refer to P.13B-365).

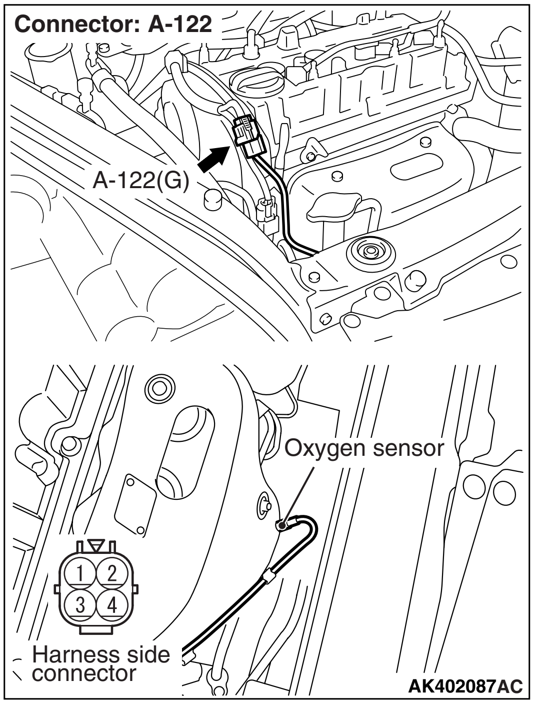
Q: Is the check result normal?

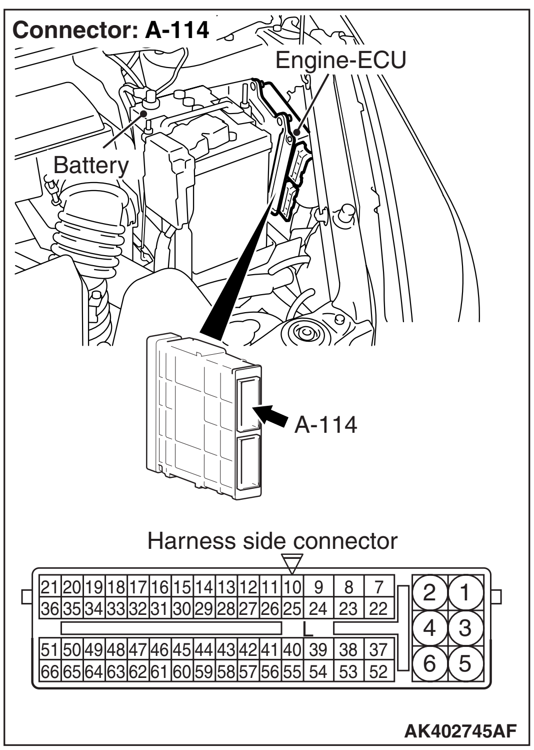
YES : Go to Step 9 .

NO : Replace the oxygen sensor (front).

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STEP 9. Check harness between A-122 (terminal No. 1) oxygen sensor (front) connector and A-114 (terminal No. 34) engine-ECU connector.





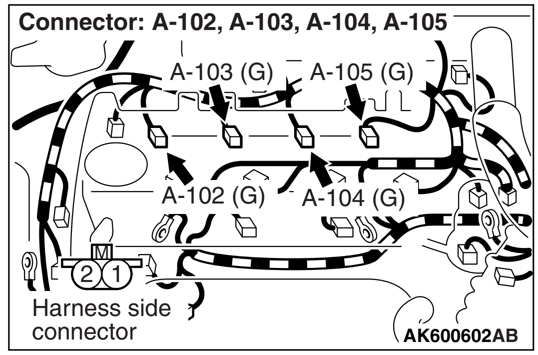
- Check output line for damage.

Q: Is the check result normal?

YES : Go to Step 10 .

NO : Repair the damaged harness wire.

STEP 10. Connector check: Injector connector



a. A-102 (No.1 injector connector)
b. A-103 (No.2 injector connector)
c. A-104 (No.3 injector connector)
d. A-105 (No.4 injector connector)

Q: Is the check result normal?

YES : Go to Step 11 .

NO : Repair or replace the connector.

STEP 11. Check injector itself.

- Check Injector itself (Refer to P.13B-367).

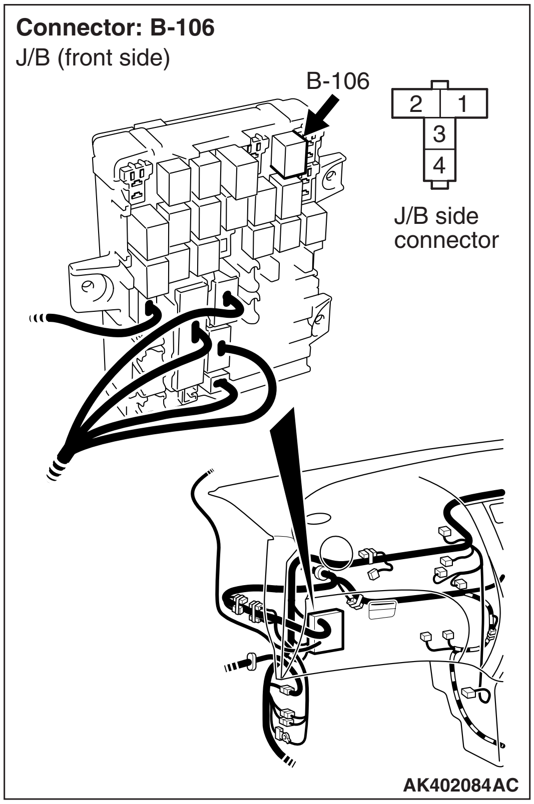
Q: Is the check result normal?

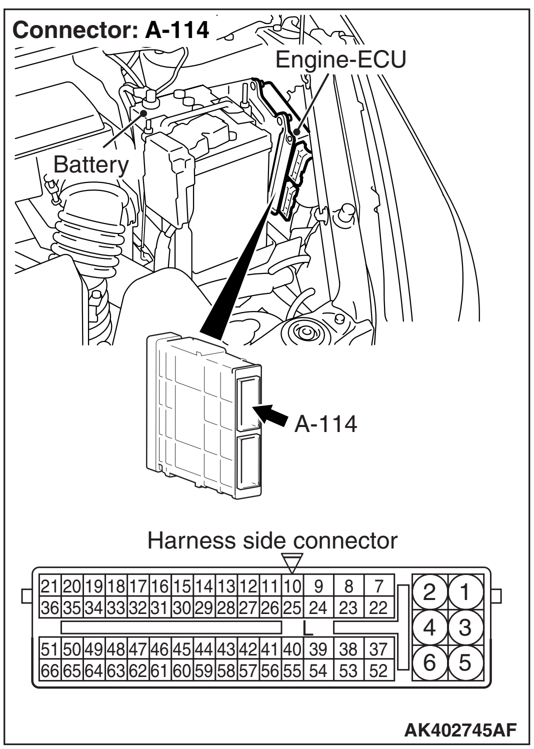
YES : Go to Step 12 .

NO : Replace the injector.

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STEP 12. Connector check: B-106 engine control relay connector and A-114 engine-ECU connector.



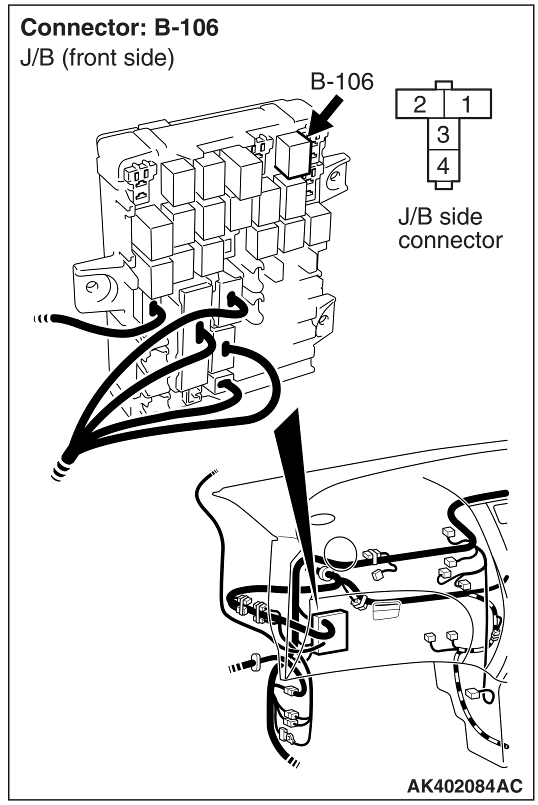


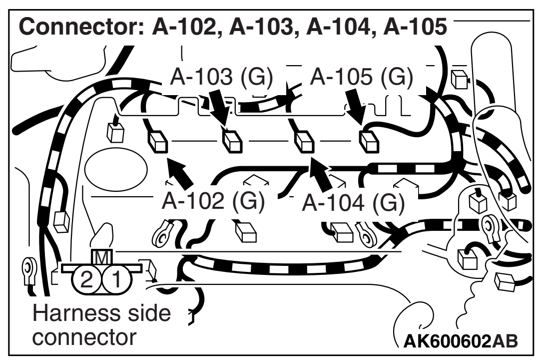
Q: Is the check result normal?

YES : Go to Step 13 .

NO : Repair or replace the connector.

STEP 13. Check harness between B-106 engine control relay connector and injector connector.





a. Check harness between B-106 (terminal No. 4) engine control relay connector and A-102 (terminal No. 1) No. 1 injector connector.

b. Check harness between B-106 (terminal No. 4) engine control relay connector and A-103 (terminal No. 1) No. 2 injector connector.

c. Check harness between B-106 (terminal No. 4) engine control relay connector and A-104 (terminal No. 1) No. 3 injector connector.

d. Check harness between B-106 (terminal No. 4) engine control relay connector and A-105 (terminal No. 1) No. 4 injector connector.

NOTE: Before checking harness, check intermediate connectors B-112 and repair if necessary.

- Check power supply line for damage.

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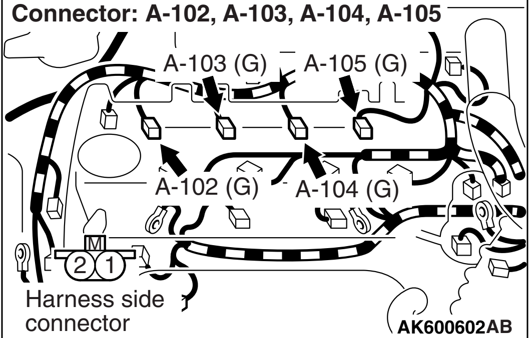
Q: Are the check results normal?

YES : Go to Step 14 .

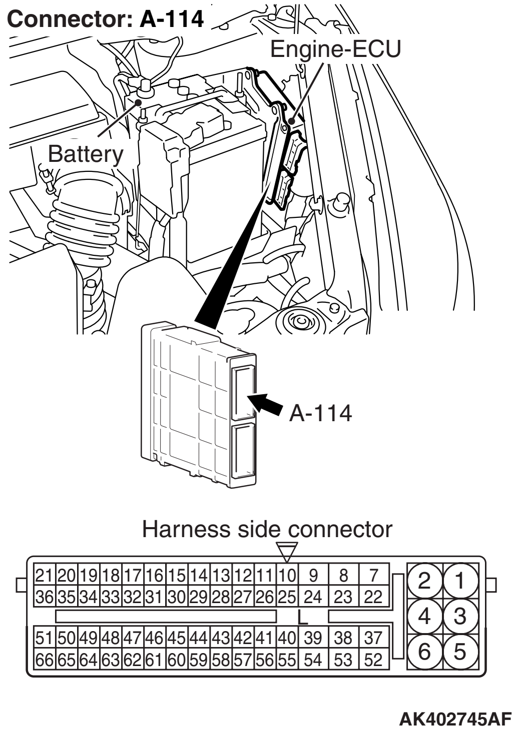
NO : Repair the damaged harness wire.

STEP 14. Check harness between injector connector and A-114 engine-ECU connector.

Connector: A-102, A-103, A-104, A-105



Connector: A-114



a. Check harness between A-102 (terminal No. 2) No. 1 injector connector and A-114 (terminal No. 8) engine-ECU connector.
b. Check harness between A-103 (terminal No. 2) No. 2 injector connector and A-114 (terminal No. 9) engine-ECU connector.
c. Check harness between A-104 (terminal No. 2) No. 3 injector connector and A-114 (terminal No. 23) engine-ECU connector.
d. Check harness between A-105 (terminal No. 2) No. 4 injector connector and A-114 (terminal No. 24) engine-ECU connector.

- Check earthing line for damage.

Q: Are the check results normal?

YES : Go to Step 15 .

NO : Repair the damaged harness wire.

STEP 15. Fuel pressure measurement.

- Fuel pressure measurement (Refer to Fuel Pressure Test P.13B-358).

Q: Is the check result normal?

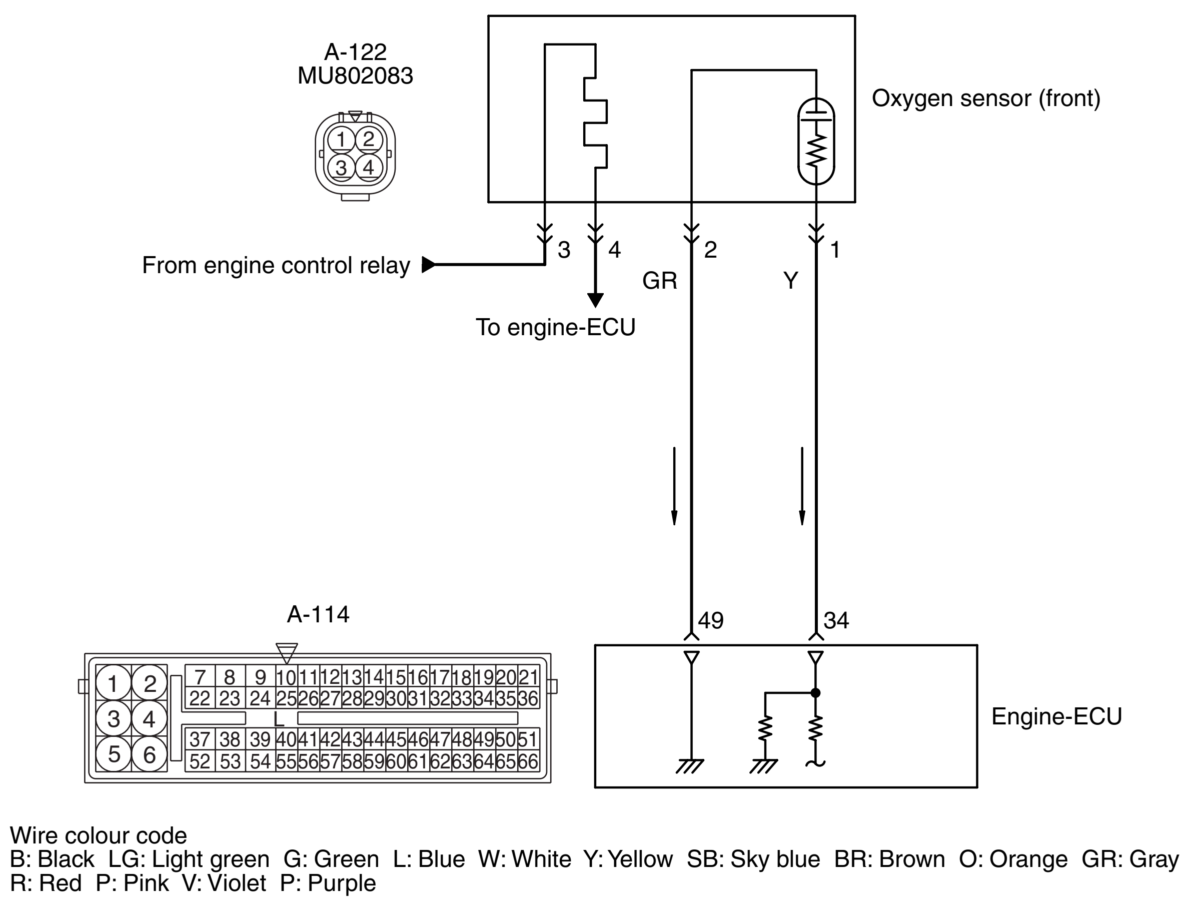
YES : Replace engine-ECU.

NO : Repair the fuel pressure.

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Code No. P0130: Oxygen Sensor (front) System

Oxygen Sensor (front) Circuit



AK600606AB

OPERATION

- The sensor signal is input to the engine-ECU (terminal No. 34) from the oxygen sensor (terminal No. 1).
- The oxygen sensor (terminal No. 2) is earthed to the engine-ECU (terminal No. 49).

FUNCTION

- The oxygen sensor (front) converts the concentration of oxygen in the exhaust emission into a voltage and inputs the signal to the engine-ECU.
- When the mixture is richer than the theoretical air-fuel ratio, the oxygen sensor (front) outputs a voltage of about 1 V. For leaner mixture, the sensor outputs a voltage of about 0 V.
- In response to the signal, the engine-ECU controls the fuel injection amount to make the mixture equal to the theoretical air-fuel ratio.

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TROUBLE JUDGEMENT

Check Conditions

- 3 minutes later from when engine starts
- For 5 seconds, engine coolant temperature is more than 80°C.
- For 5 seconds, engine speed is more than 1,200r/min.
- The volume efficiency for 5 seconds is 50% or more.

Judgement Criterion

- When 5 V is applied to oxygen sensor (front) output line via register, engine-ECU-interface output voltage is more than 4.0 V.

Check Conditions

- Engine speed is more than 1,500 r/min and is less than 3,000 r/min.
- Engine coolant temperature is more than 60°C.
- The volume efficiency is more than 20% and is less than 45%.
- Within the range of air-fuel ratio feed back operation

Judgement Criterion

- The average output frequency of the oxygen sensor (front) is 3 times or less for 12 seconds.

PROBABLE CAUSES

- Failed oxygen sensor (front)
- Open/short circuit or damage in oxygen sensor circuit, or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list

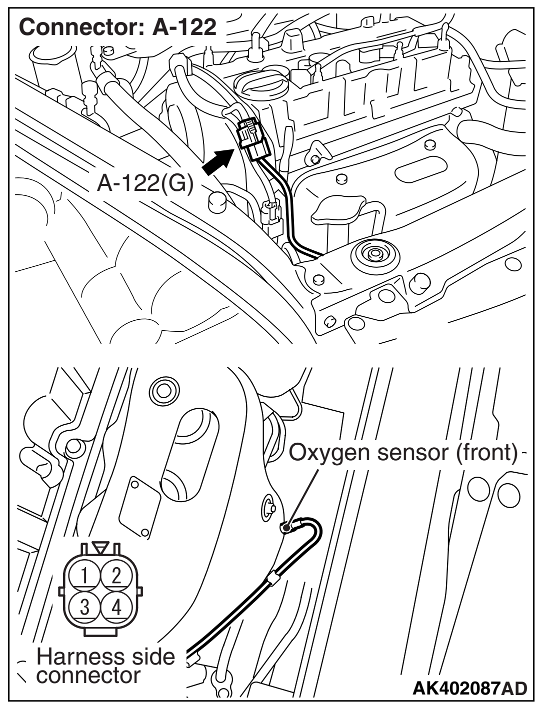
- Refer to Data List Reference Table P.13B-335.
  a. Item 11: Oxygen sensor (front)

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

NO : Go to Step 2 .

STEP 2. Connector check: A-122 oxygen sensor (front) connector

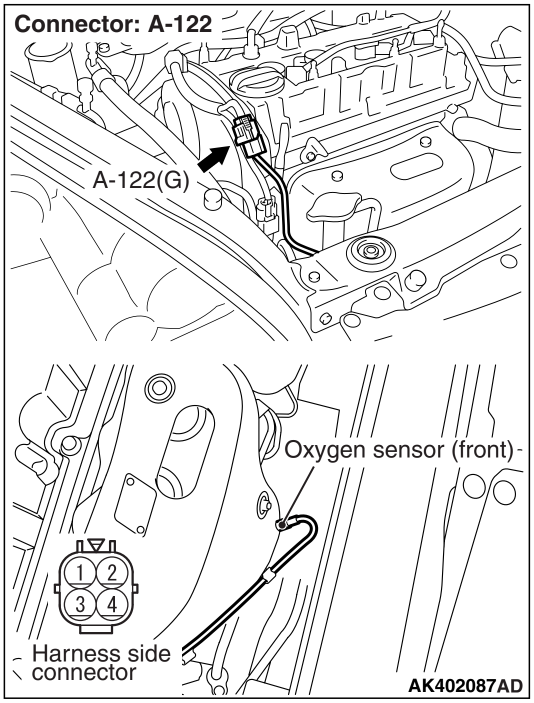


Q: Is the check result normal?

YES : Go to Step 3 .

NO : Repair or replace.

STEP 3. Perform resistance measurement at A-122 oxygen sensor (front) connector.



- Disconnect connector and measure at harness side.
- Resistance between terminal No. 2 and earth.

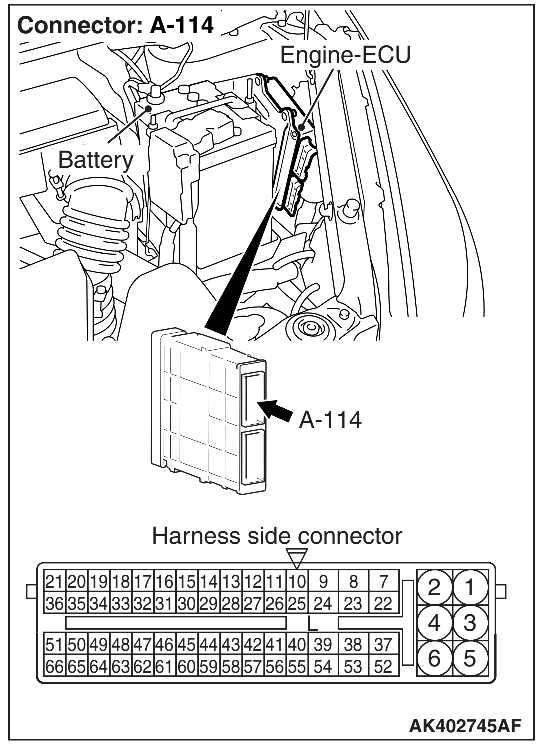
OK: Continuity (2 Ω or less)

Q: Is the check result normal?

YES : Go to Step 7 .

NO : Go to Step 4 .

STEP 4. Connector check: A-114 engine-ECU connector



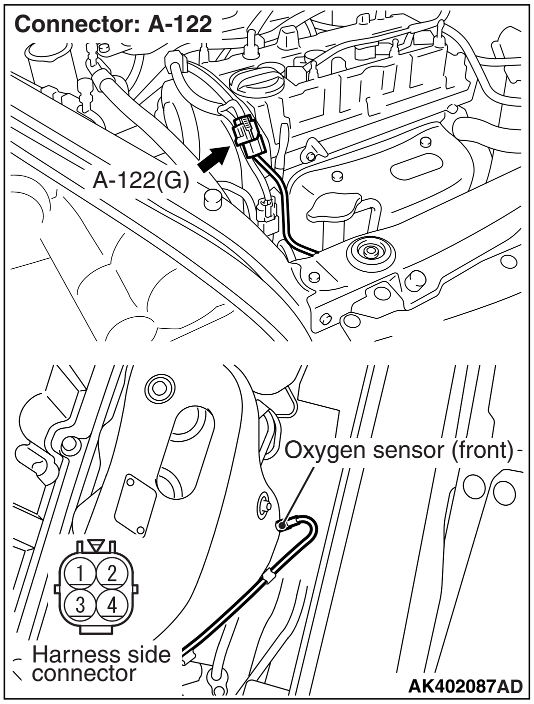
Q: Is the check result normal?

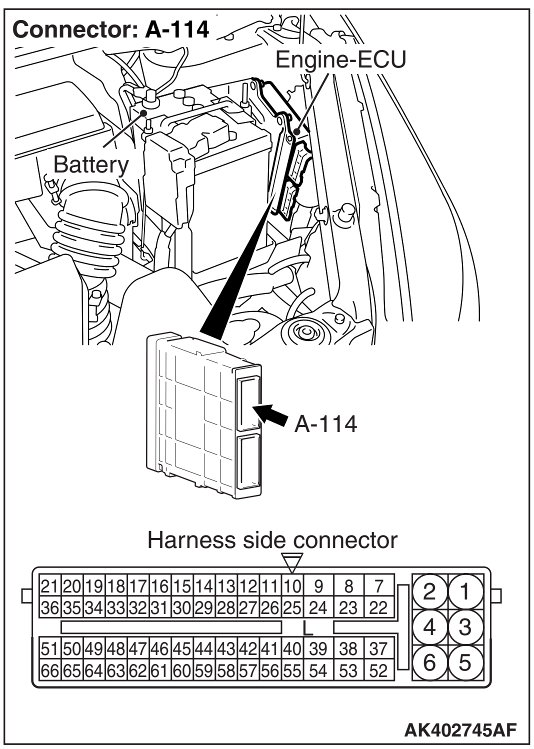
YES : Go to Step 5 .

NO : Repair or replace.

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STEP 5. Check harness between A-122 (terminal No. 2) oxygen sensor (front) connector and A-114 (terminal No. 49) engine-ECU connector.





- Check earthing line for open circuit and damage.

Q: Is the check result normal?

YES : Go to Step 6 .

NO : Repair.

STEP 6. M.U.T.-III data list

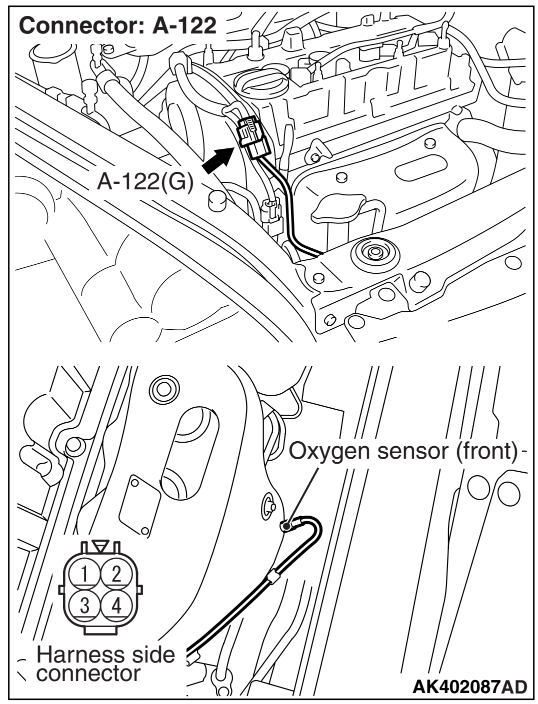
- Refer to Data List Reference Table P.13B-335.
  a. Item 11: Oxygen sensor (front)

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

NO : Replace engine-ECU.

STEP 7. Perform voltage measurement at A-122 oxygen sensor (front) connector.



- Use special tool test harness (MB991658) to connect connector, and measure at pick-up harness.
- Engine: After warm-up
- Ignition switch: ON
- Voltage between terminal No. 2 and earth.

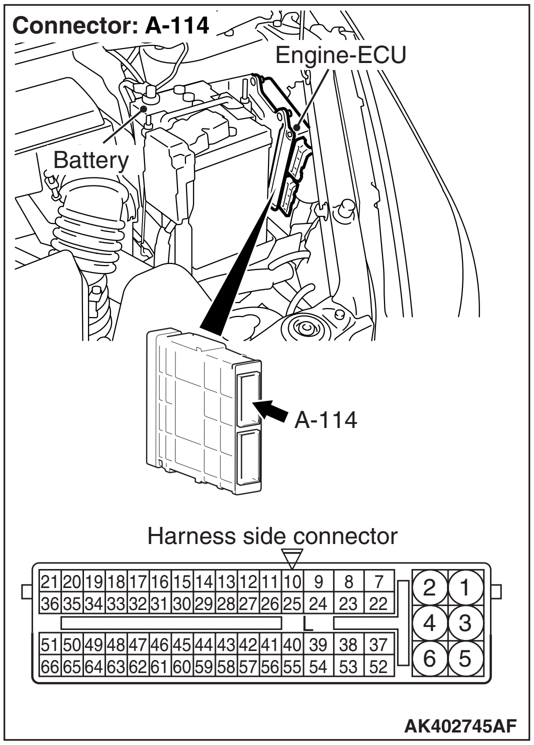
OK: 0.5 V or less

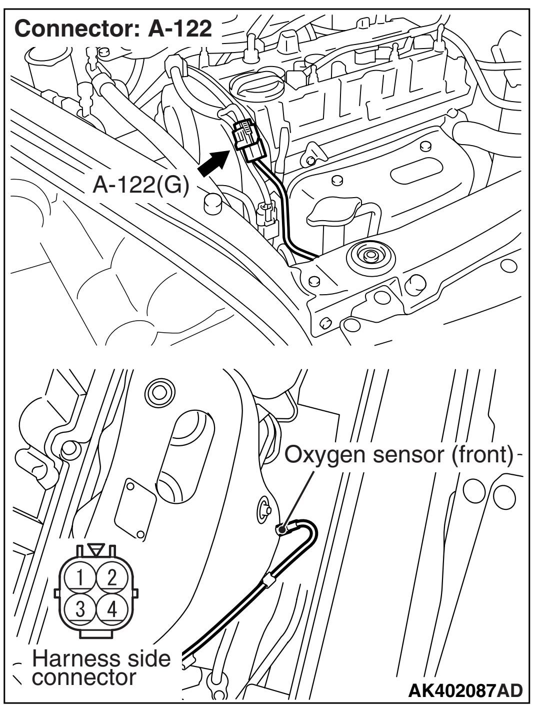
Q: Is the check result normal?

YES : Go to Step 9 .

NO : Go to Step 8 .

STEP 8. Connector check: A-114 engine-ECU connector





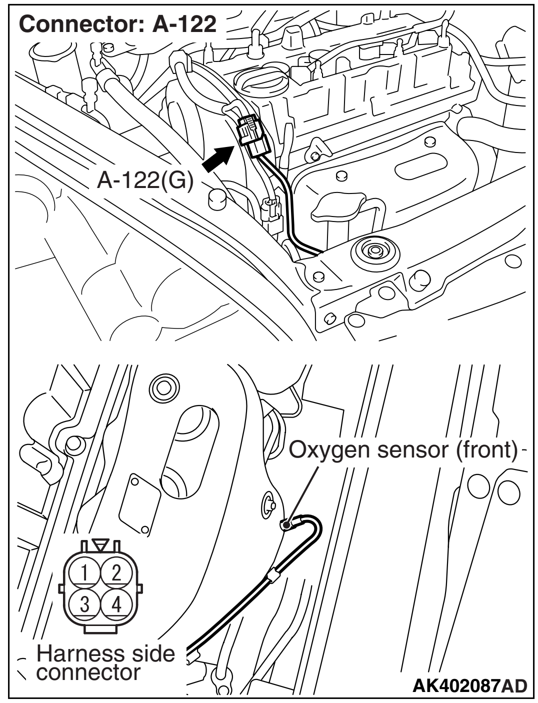
Q: Is the check result normal?

YES : Check and repair harness between A-122 (terminal No. 2) oxygen sensor (front) connector and A-114 (terminal No.49) engine-ECU connector.

- Check earthing line for damage.

NO : Repair or replace.

STEP 9. Perform voltage measurement at A-122 oxygen sensor (front) connector.



- Use special tool test harness (MB991658) to connect connector, and measure at pick-up harness.
- Transmission: P range
- Engine: Idling after warm-up
- Voltage between terminal No. 1 and earth.

OK:

When the engine is idling and running at 2,500 r/min, the output voltage repeats changing between 0 and 0.8 V.

When the engine is rapidly decelerated from 4,000 r/min, the output voltage below 200 mV increases to between 600 and 1,000 mV after a lapse of a few seconds.

Q: Is the check result normal?

YES : Go to Step 12 .

NO : Go to Step 10 .

STEP 10. Check oxygen sensor (front) itself.

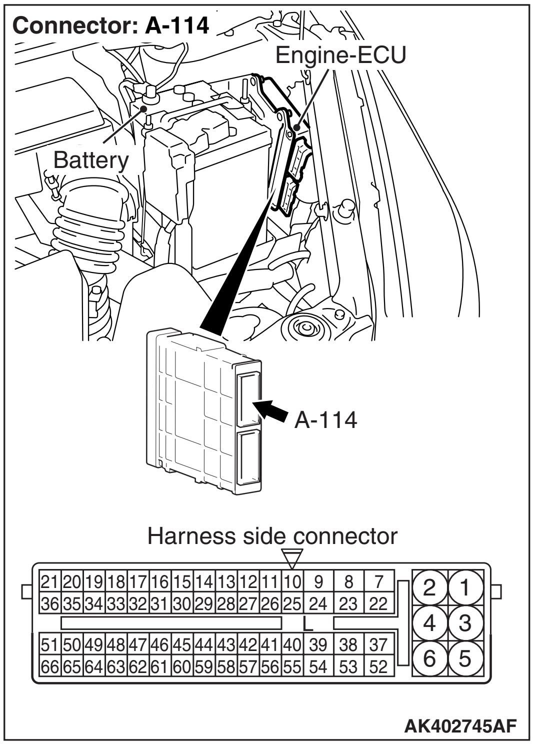
- Check oxygen sensor (front) itself (Refer to P.13B-365).

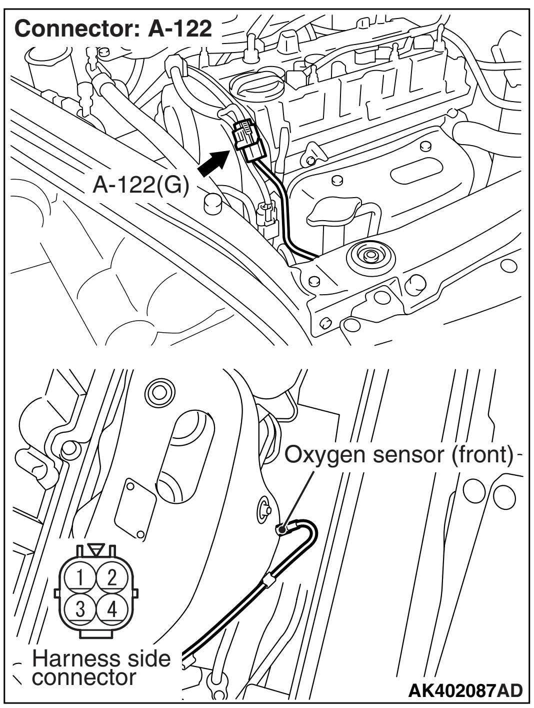
Q: Is the check result normal?

YES : Go to Step 11 .

NO : Replace oxygen sensor.

STEP 11. Connector check: A-114 engine-ECU connector





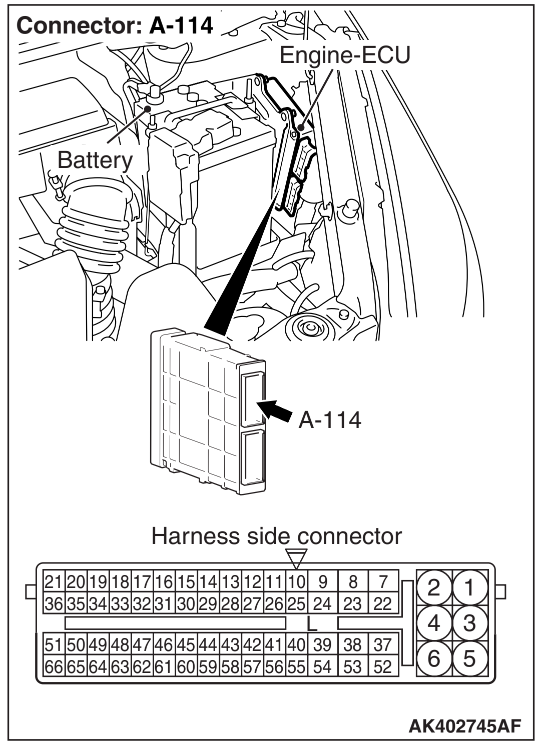
Q: Is the check result normal?

YES : Check and repair harness between A-122 (terminal No. 1) oxygen sensor (front) connector and A-114 (terminal No. 34) engine-ECU connector.

- Check output line for damage.

NO : Repair or replace.

STEP 12. Perform voltage measurement at A-114 engine-ECU connector.



- Disconnect connector, connect special tool power plant ECU check harness (MB991987) and measure the voltage on the check connector.
- Transmission: Neutral
- Engine: Idling after warm-up
- Voltage between terminal No. 34 and earth.

OK:

When the engine is idling and running at 2,500 r/min, the output voltage repeats changing between 0 and 0.8 V.

When the engine is rapidly decelerated from 4,000 r/min, the output voltage below 200 mV increases to between 600 and 1,000 mV after a lapse of a few seconds.

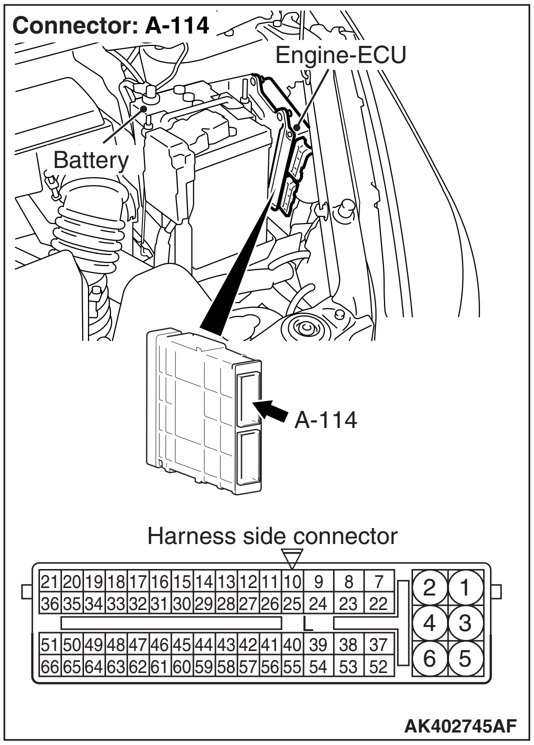
Q: Is the check result normal?

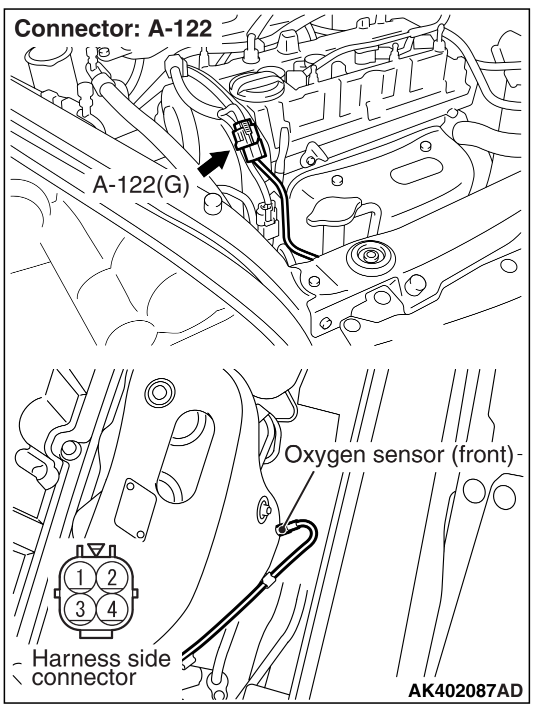
YES : Go to Step 14 .

NO : Go to Step 13 .

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STEP 13. Connector check: A-114 engine-ECU connector





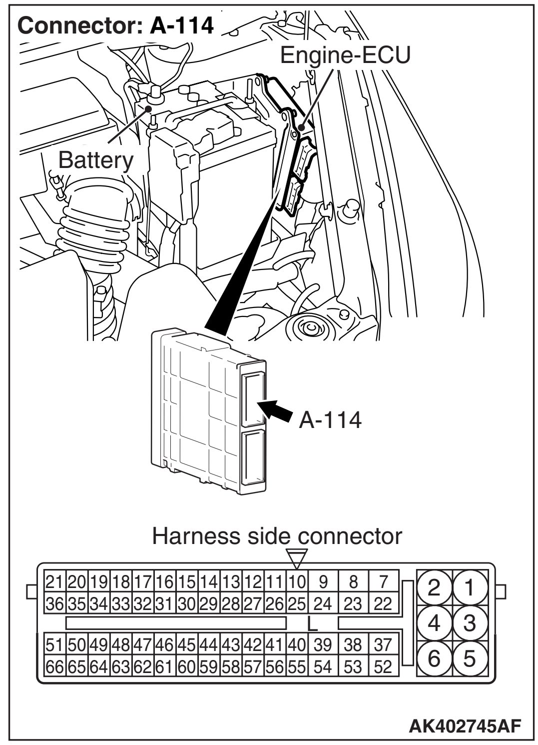
Q: Is the check result normal?

YES : Check and repair harness between A-122 (terminal No. 1) oxygen sensor (front) connector and A-114 (terminal No. 34) engine-ECU connector.

- Check output line for open circuit.

NO : Repair or replace.

STEP 14. Connector check: A-114 engine-ECU connector



Q: Is the check result normal?

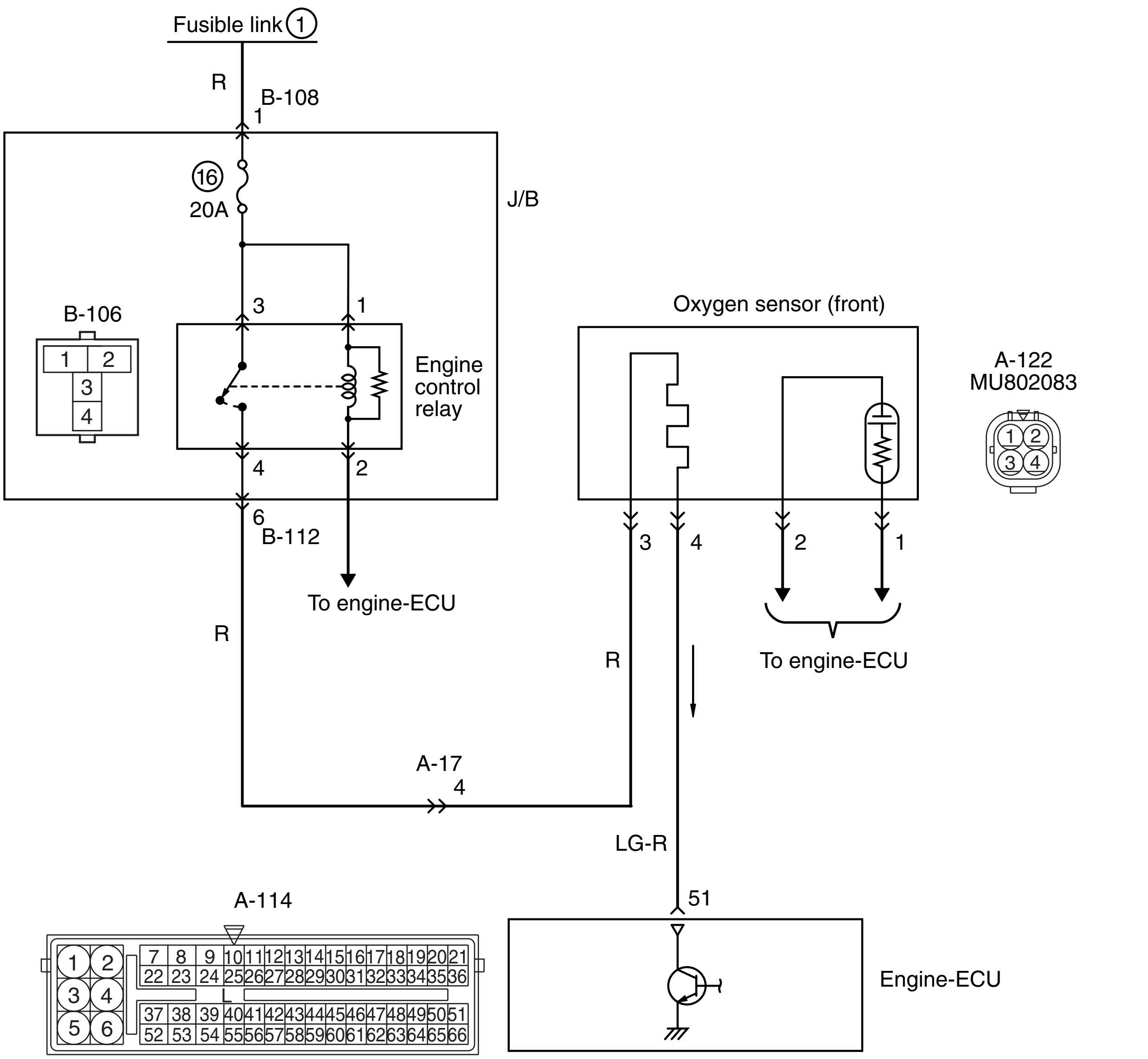
YES : Go to Step 6 .

NO : Repair or replace.

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Code No. P0135: Oxygen Sensor (front) Heater System

Oxygen Sensor Heater (front) Circuit



Wire colour code
B: Black LG: Light green G: Green L: Blue W: White Y: Yellow SB: Sky blue BR: Brown O: Orange GR: Gray
R: Red P: Pink V: Violet P: Purple

AK402681AE

OPERATION

- Power is supplied to the heater power terminal (terminal No. 3) of the oxygen sensor (front) connector from the engine control relay (terminal No. 4).
- The heater (terminal No. 4) of the oxygen sensor (front) connector is controlled by the power transistor in the engine-ECU (terminal No. 51).

FUNCTION

- Power supply to the oxygen sensor (front) heater is controlled through ON-OFF control of the power transistor in the engine-ECU.
- The oxygen sensor (front) heater helps the oxygen sensor be highly responsive particularly when the exhaust emission temperature is low.

TROUBLE JUDGEMENT

Check Condition

- After engine starts
- Engine coolant temperature is more than 20°C.
- Battery voltage is more than 11 V and is less than 16 V.

Judgement Criterion

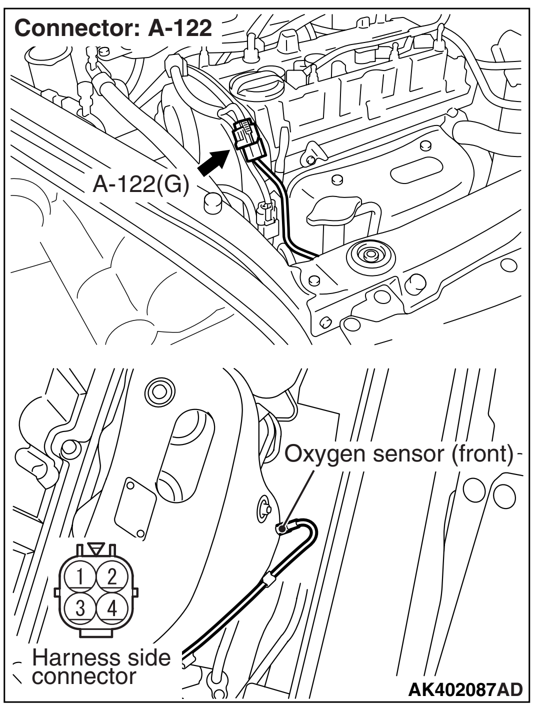
- For 4 seconds, oxygen sensor (front) heater current is less than 0.16 A or more than 5.0 A.

PROBABLE CAUSES

- Failed oxygen sensor (front) heater
- Open/short circuit or damage in oxygen sensor heater circuit, or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Connector check: A-122 oxygen sensor (front) connector

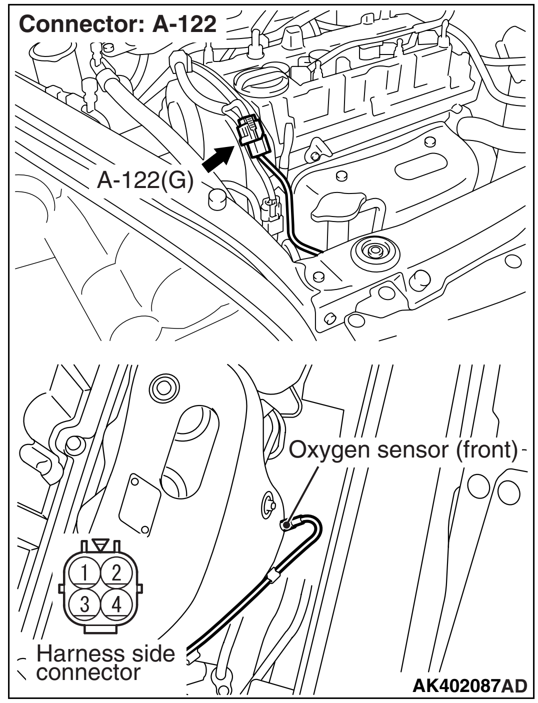


Q: Is the check result normal?

YES : Go to Step 2 .

NO : Repair or replace.

STEP 2. Perform resistance measurement at A-122 oxygen sensor (front) connector.



- Disconnect connector and measure at sensor side.
- Resistance between terminals No. 3 and No. 4.

OK: 5 – 30 Ω (at 20°C)

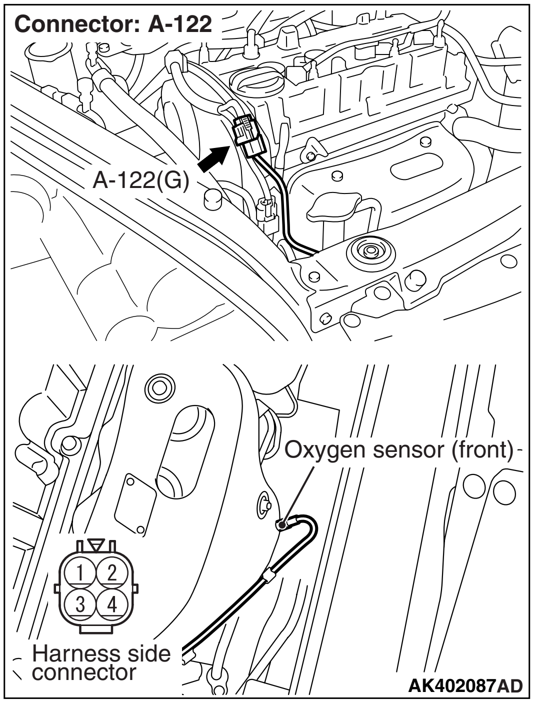
Q: Is the check result normal?

YES : Go to Step 3 .

NO : Replace oxygen (front) sensor.

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STEP 3. Perform voltage measurement at A-122 oxygen sensor (front) connector.



- Disconnect connector and measure at harness side.
- Ignition switch: ON
- Voltage between terminal No. 3 and earth.

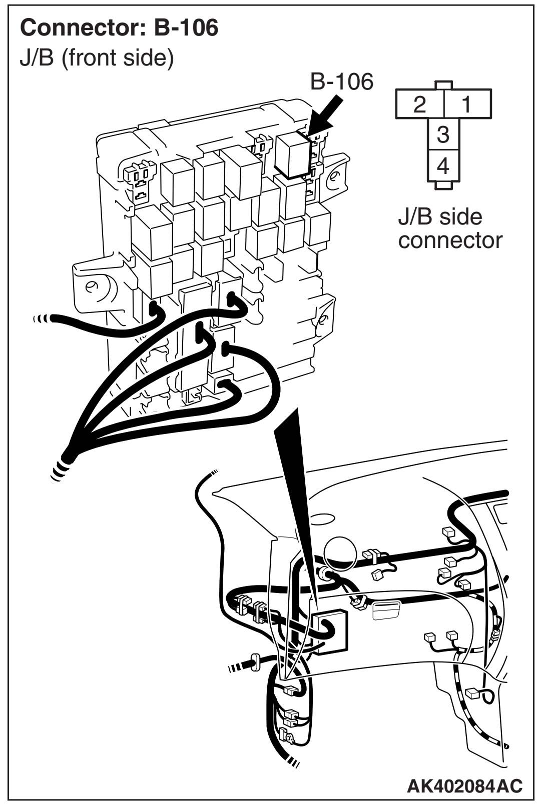
OK: System voltage

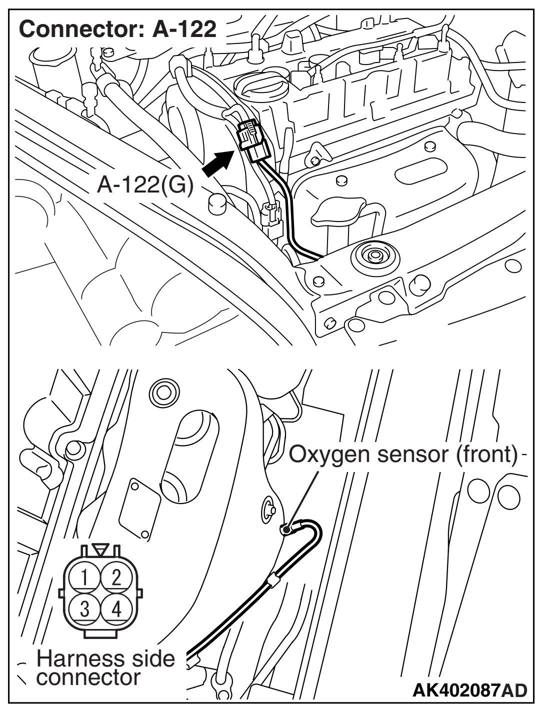
Q: Is the check result normal?

YES : Go to Step 5 .

NO : Go to Step 4 .

STEP 4. Connector check: B-106 engine control relay connector





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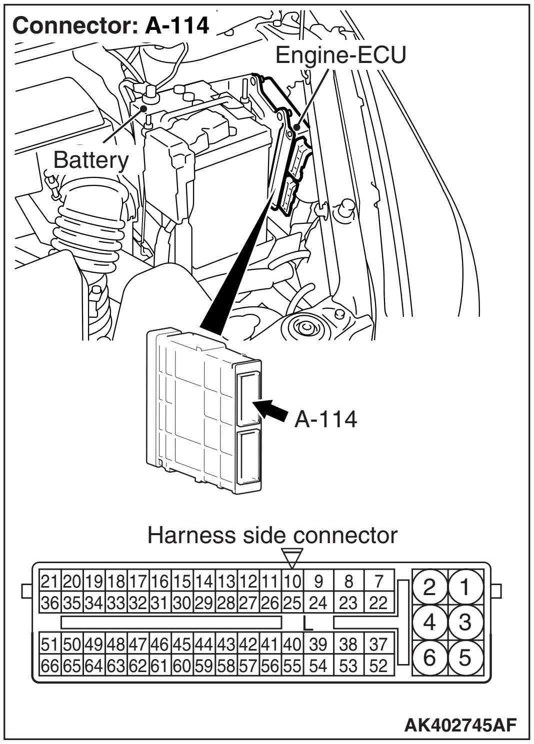
Q: Is the check result normal?

YES : Check intermediate connector A-17 and B-112, and repair if necessary. If intermediate connectors are normal, check and repair harness between A-122 (terminal No. 3) oxygen sensor (front) connector and B-106 (terminal No. 4) engine control relay connector.

- Check power supply line for open/short circuit.

NO : Repair or replace.

STEP 5. Perform voltage measurement at A-114 engine-ECU connector.



- Disconnect engine-ECU connector, and connect special tool power plant ECU check harness (MB991987) and measure the voltage on the check connector.
- Ignition switch: ON
- Voltage between terminal No. 51 and earth.

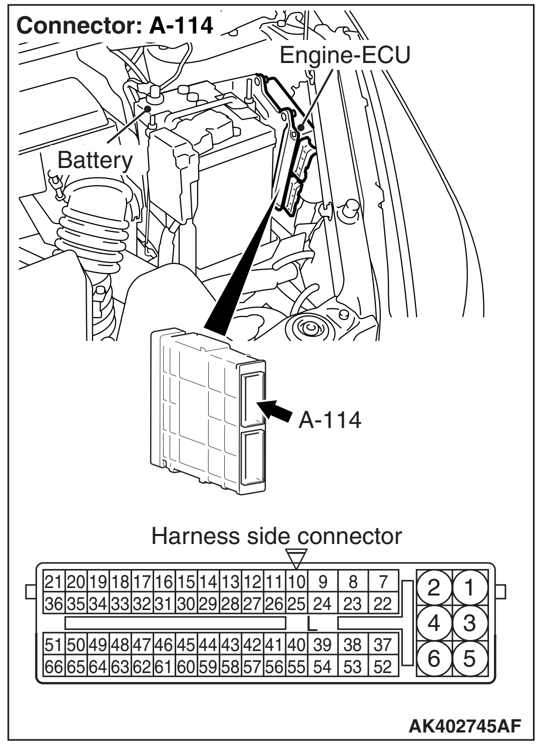
OK: System voltage

Q: Is the check result normal?

YES : Go to Step 8 .

NO : Go to Step 6 .

STEP 6. Connector check: A-114 engine-ECU connector



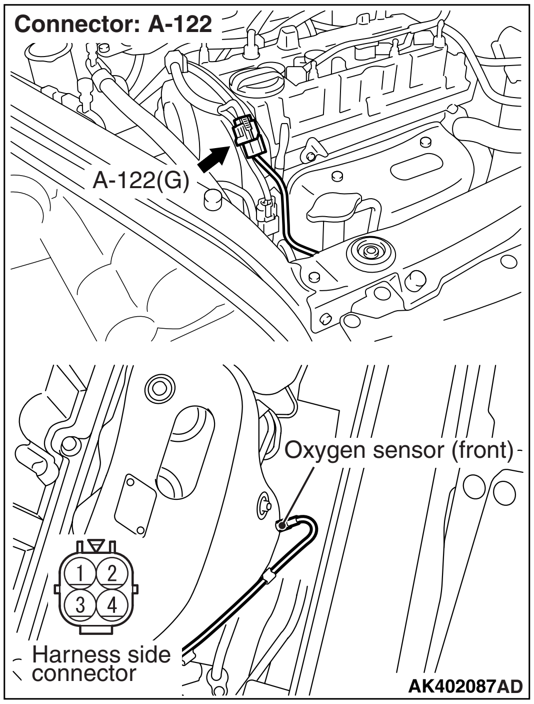
Q: Is the check result normal?

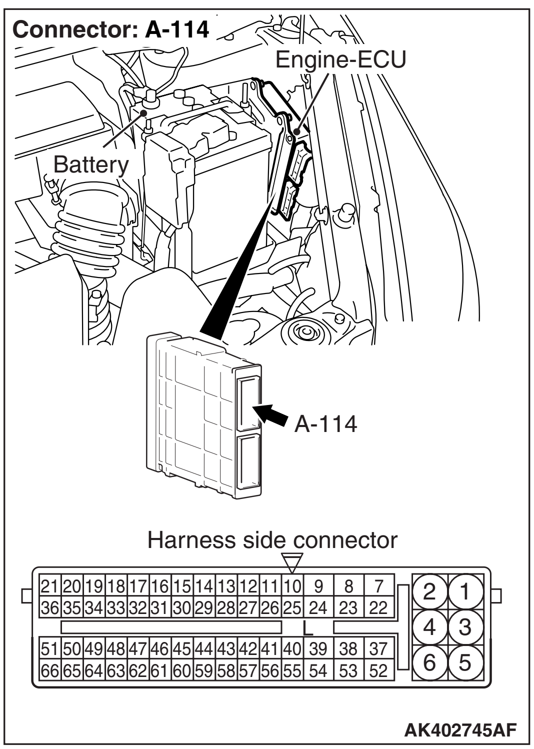
YES : Go to Step 7 .

NO : Repair or replace.

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STEP 7. Check harness between A-122 (terminal No. 4) oxygen sensor (front) connector and A-114 (terminal No. 51) engine-ECU connector.

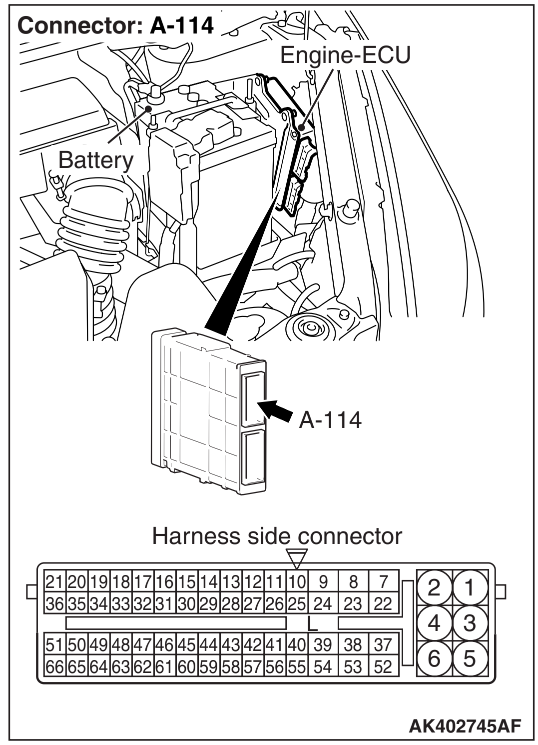




- Check earthing line for open/short circuit.

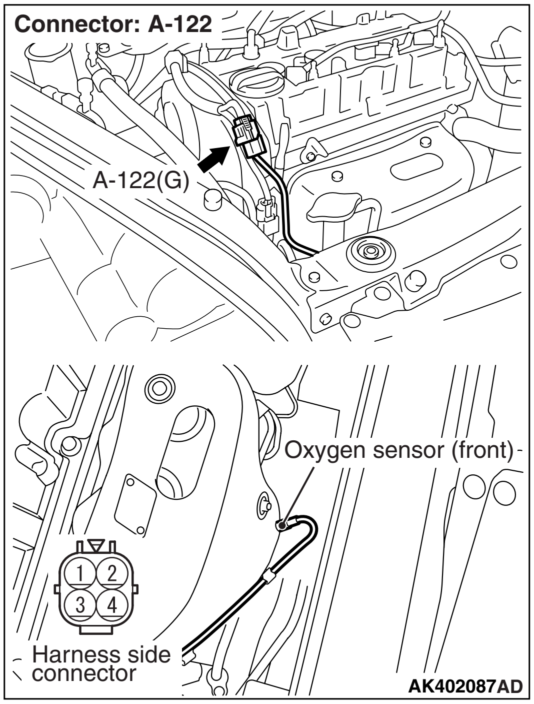
Q: Is the check result normal?
YES : Replace engine-ECU.
NO : Repair.

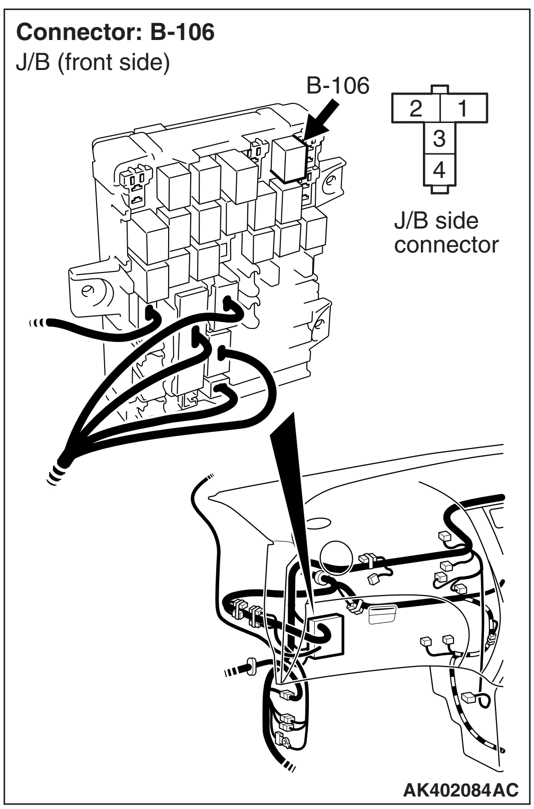
STEP 8. Connector check: A-114 engine-ECU connector



Q: Is the check result normal?
YES : Go to Step 9 .
NO : Repair or replace.

STEP 9. Check harness between A-122 (terminal No. 3) oxygen sensor (front) connector and B-106 (terminal No. 4) engine control relay connector.





NOTE: Before checking harness, check intermediate connectors A-17 and B-112 and repair if necessary.

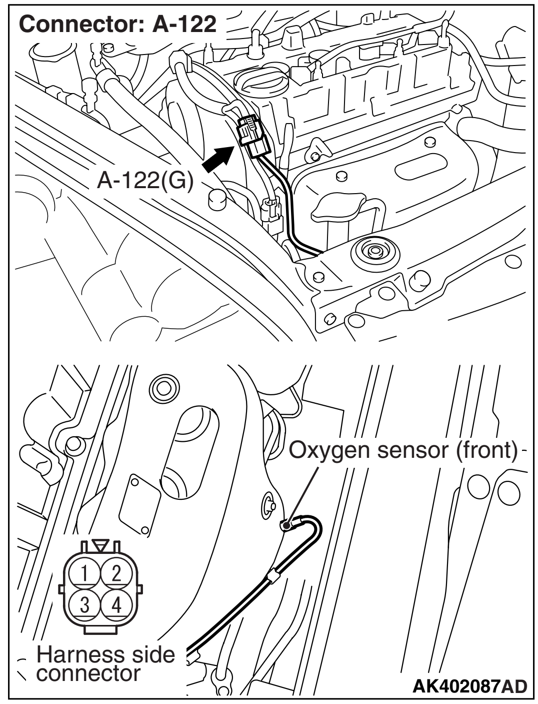
- Check power supply line for damage.

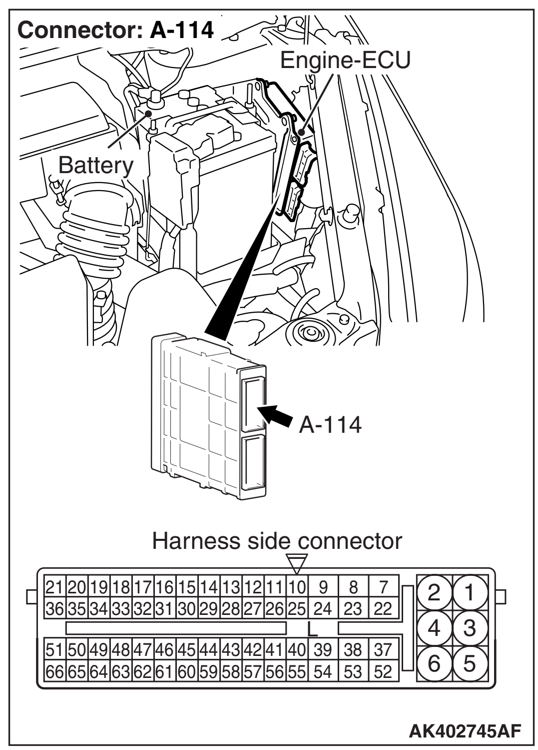
Q: Is the check result normal?

YES : Go to Step 10 .

NO : Repair.

STEP 10. Check harness between A-122 (terminal No. 4) oxygen sensor (front) connector and A-114 (terminal No. 51) engine-ECU connector.





- Check earthing line for damage.

Q: Is the check result normal?

YES : Go to Step 11 .

NO : Repair.

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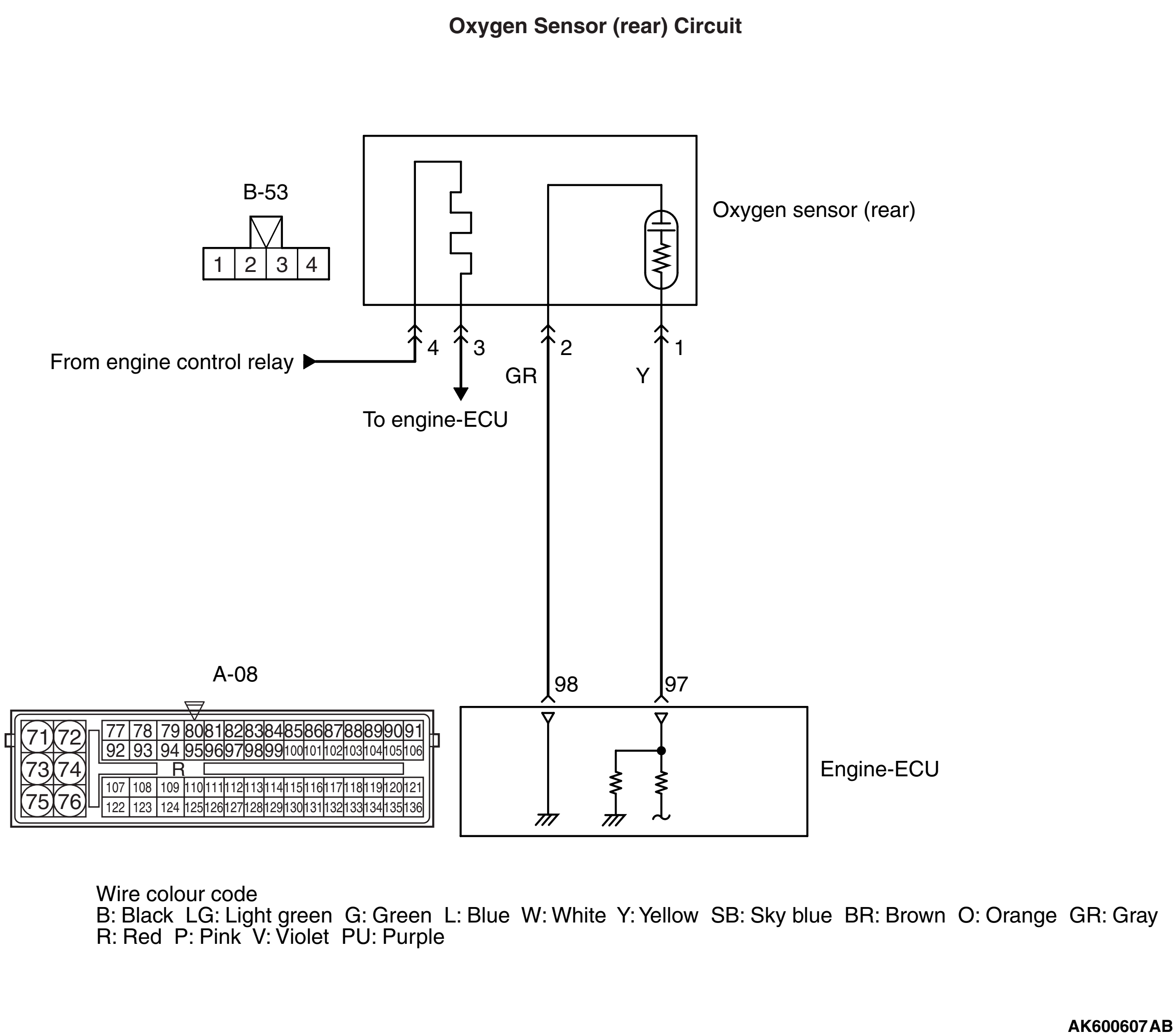
STEP 11. M.U.T.-III diagnosis code

Q: Is the diagnosis code output?

YES : Replace engine-ECU.

NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

Code No. P0136: Oxygen Sensor (Rear) System



OPERATION

- The sensor signal is inputted to the engine-ECU (terminal No. 97) from the oxygen sensor (rear) output terminal (terminal No. 1).
- The oxygen sensor (rear) (terminal No. 2) is earthed with engine-ECU (terminal No. 98).

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FUNCTION

- The oxygen sensor (rear) converts the concentration of oxygen in the exhaust emission into a voltage and inputs the signal to the engine-ECU.
- When the air-fuel ratio is richer than the theoretical air-fuel ratio, the oxygen sensor (rear) outputs a voltage of about 1 V. When it is leaner than the theoretical air-fuel ratio, it outputs a voltage of about 0 V.
- Based on this signal, the engine-ECU corrects the deviation in the signal that is output by the oxygen sensor (rear).

TROUBLE JUDGMENT

Check Conditions

- 3 minutes later from when engine starts
- For 5 seconds, engine coolant temperature is more than 80°C.
- For 5 seconds, engine speed is more than 1,200 r/min.
- The volume efficiency for 5 seconds is 50% or more.

Judgement Criterion

- When 5 V is applied to oxygen sensor (rear) output line via register, engine-ECU-interface output voltage is more than 4.0 V.

PROBABLE CAUSES

- Failed oxygen sensor (rear)
- Open/short circuit and damage in oxygen sensor (rear) circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list

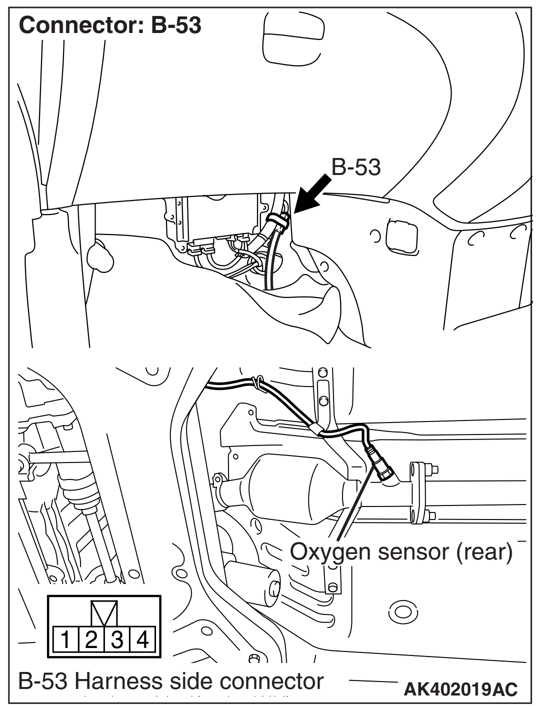
- Refer to Data List Reference Table P.13B-335.
  a. Item No. 59: Oxygen sensor (rear)

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

NO : Go to Step 2 .

STEP 2. Connector check: B-53 oxygen sensor (rear) connector



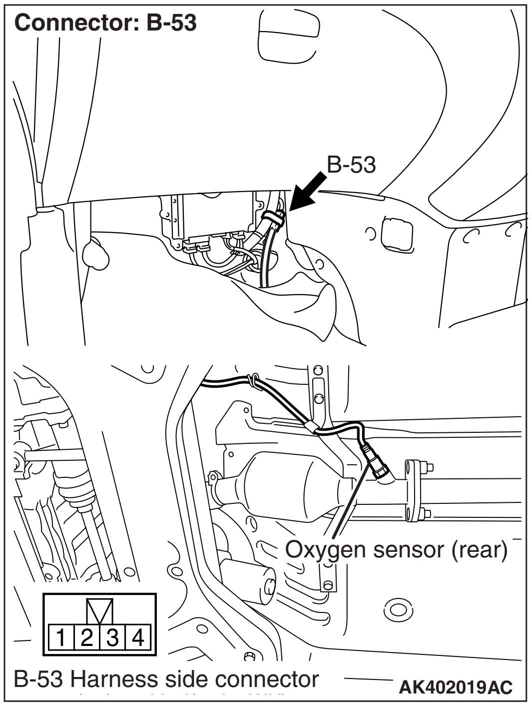
Q: Is the check result normal?

YES : Go to Step 3 .

NO : Repair or replace the connector.

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STEP 3. Perform resistance measurement at B-53 oxygen sensor (rear) connector.



- Disconnect connector, and measure at harness side.
- Resistance between terminal No. 2 and earth.

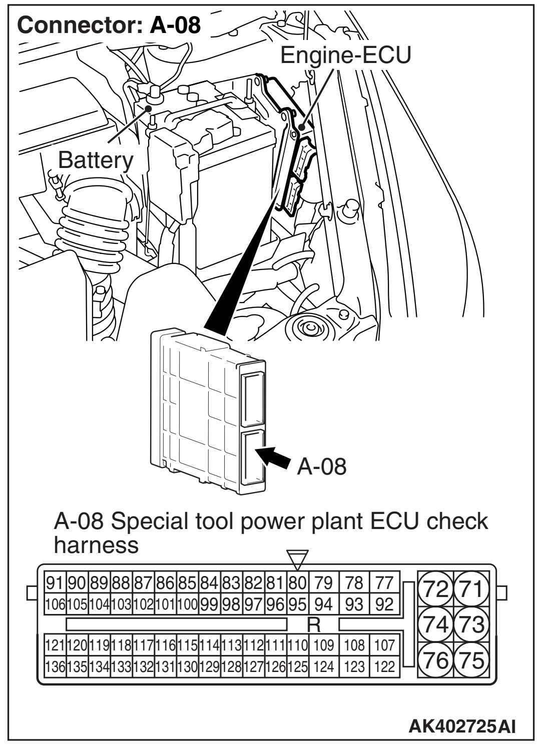
OK: Continuity (2 Ω or less)

Q: Is the check result normal?

YES : Go to Step 7 .

NO : Go to Step 4 .

STEP 4. Connector check: A-08 engine-ECU connector

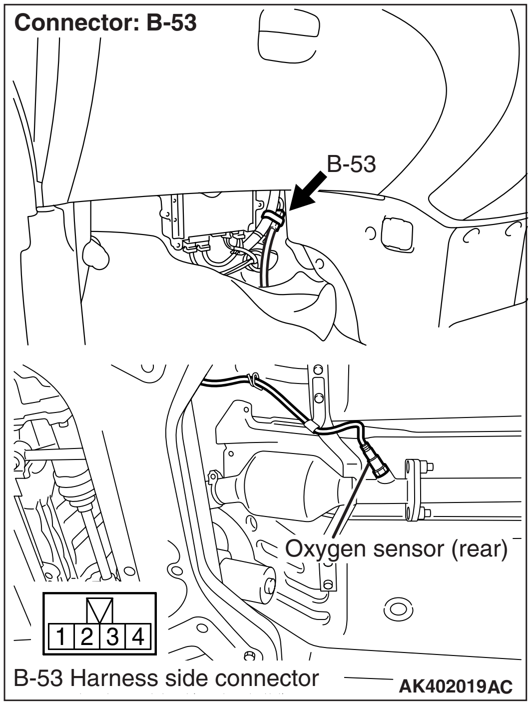


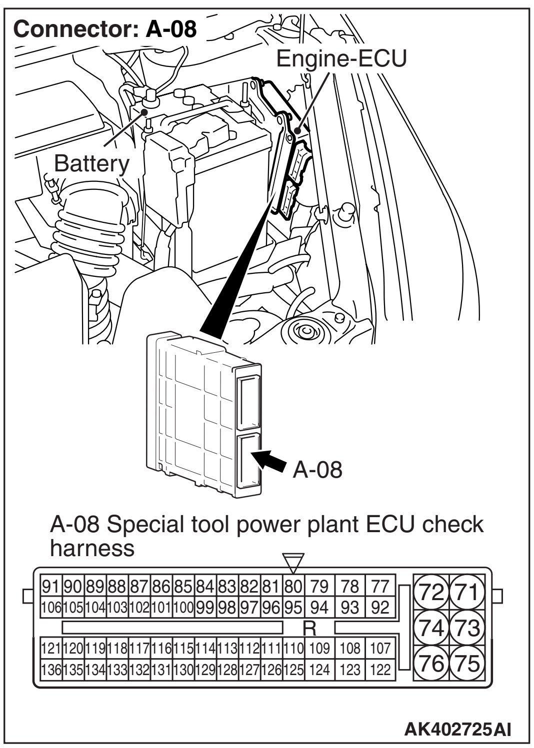
Q: Is the check result normal?

YES : Go to Step 5 .

NO : Repair or replace the connector.

STEP 5. Check harness between B-53 (terminal No. 2) oxygen sensor (rear) connector and A-08 (terminal No. 98) engine-ECU connector.





- Check earthing line for open circuit and damage.

Q: Is the check result normal?

YES : Go to Step 6 .

NO : Repair the damaged harness wire.

STEP 6. M.U.T.-III data list

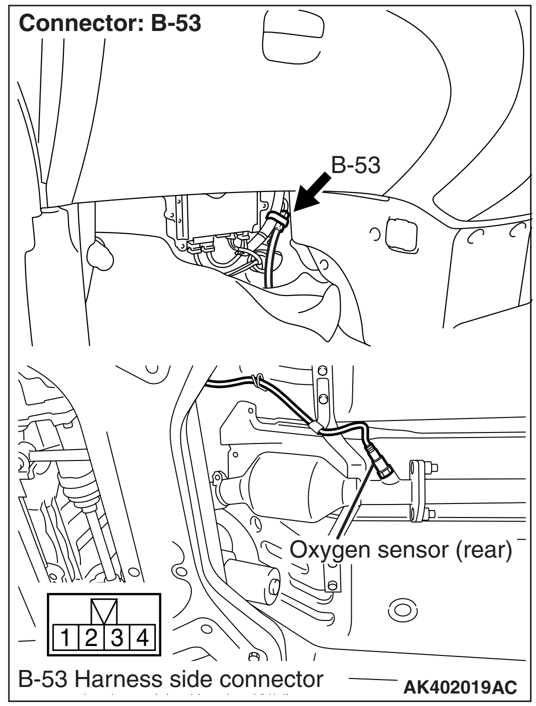
- Refer to Data List Reference Table P.13B-335.
  a. Item No. 59: Oxygen sensor (rear)

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

NO : Replace engine-ECU.

STEP 7. Perform voltage measurement at B-53 oxygen sensor (rear) connector.



- Use special tool test harness (MB991658) to connect connector, and measure at pick-up harness.
- Engine: After warm-up
- Transmission: Neutral
- Voltage between terminal No. 1 and earth.

OK:

When the engine is 2,500 r/min, the output voltage should repeat 0 to 0.8 V alternately

Q: Is the check result normal?

YES : Go to Step 10 .

NO : Go to Step 8 .

STEP 8. Check Oxygen sensor (rear) itself.

- Check oxygen sensor (rear) itself (Refer to P.13B-365).

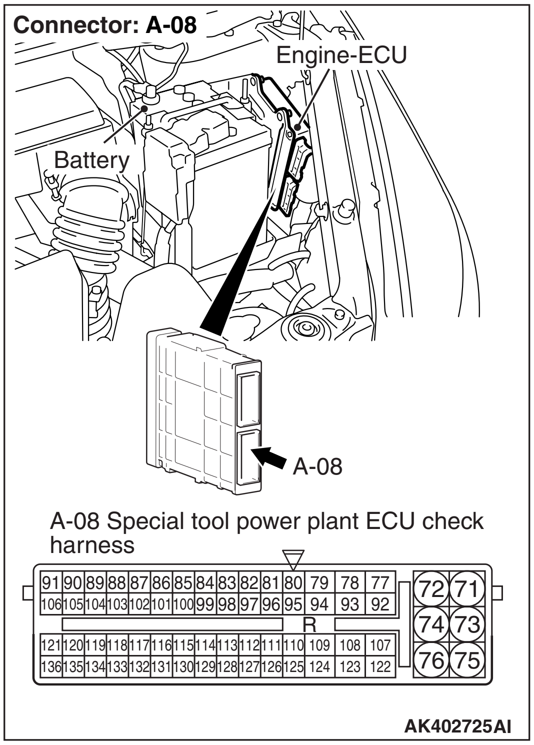
Q: Is the check result normal?

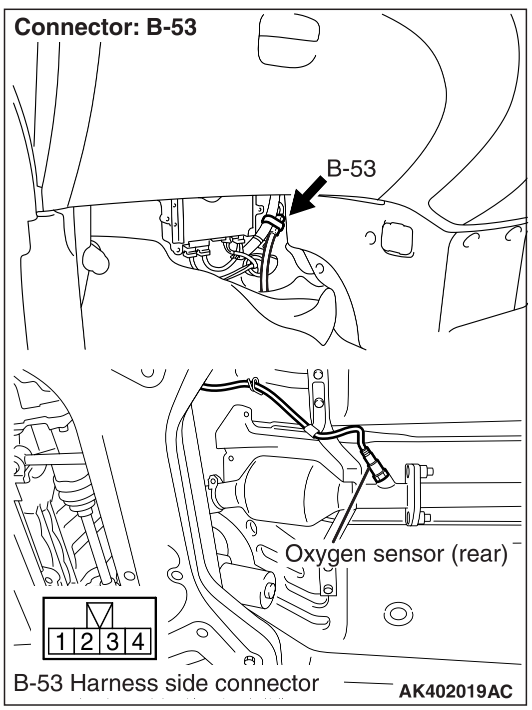
YES : Go to Step 9 .

NO : Replace the oxygen sensor (rear).

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STEP 9. Connector check: A-08 engine-ECU connector





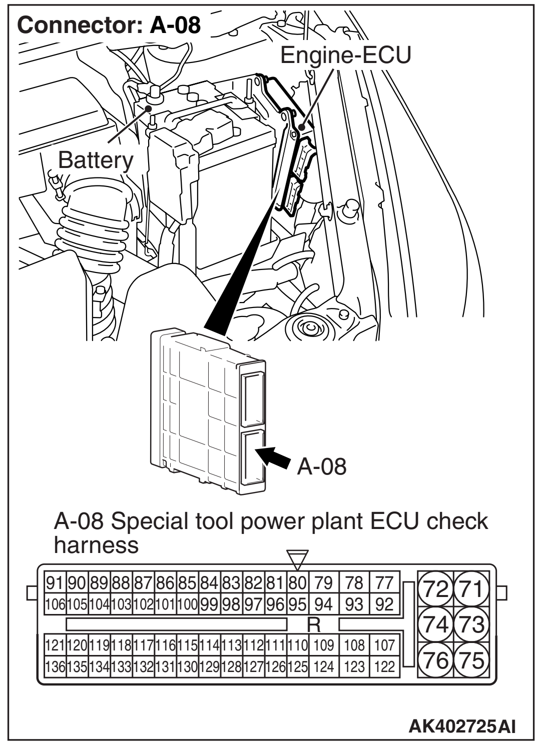
Q: Is the check result normal?

YES : Check and repair harness between B-53 (terminal No. 1) oxygen sensor (rear) connector and A-08 (terminal No. 97) engine-ECU connector.

- Check output line for short circuit.

NO : Repair or replace the connector.

STEP 10. Perform voltage measurement at A-08 engine-ECU connector.



- Disconnect engine-ECU connector, and connect special tool power plant ECU check harness (MB991987), and then measure the voltage on the check connector.
- Transmission: Neutral
- Engine: After warm-up
- Voltage between terminal No. 97 and earth.

OK:
When the engine is 2,500 r/min, the output voltage should repeat 0 to 0.8 V alternately.

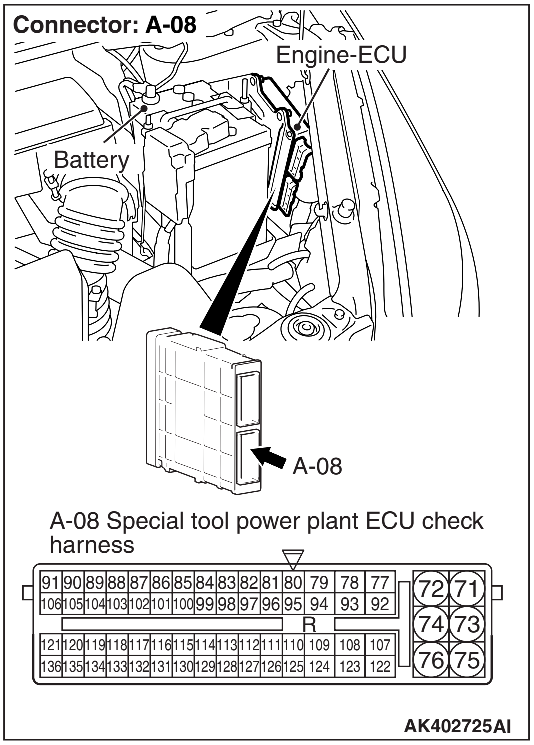
Q: Is the check result normal?

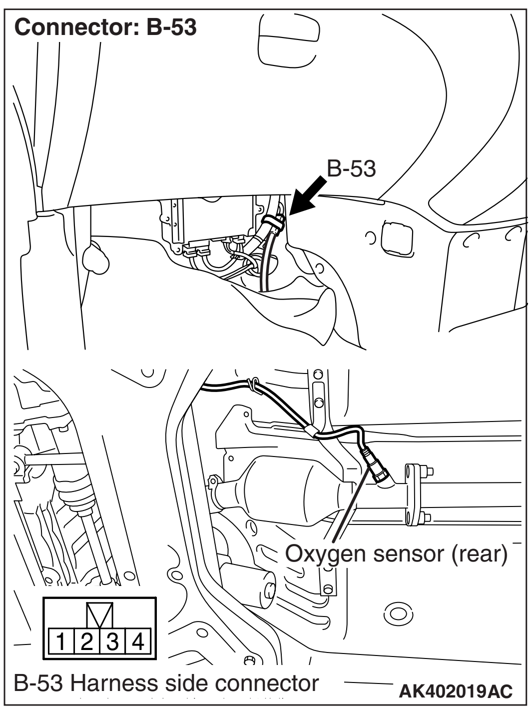
YES : Go to Step 12 .

NO : Go to Step 11 .

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STEP 11. Connector check: A-08 engine-ECU connector





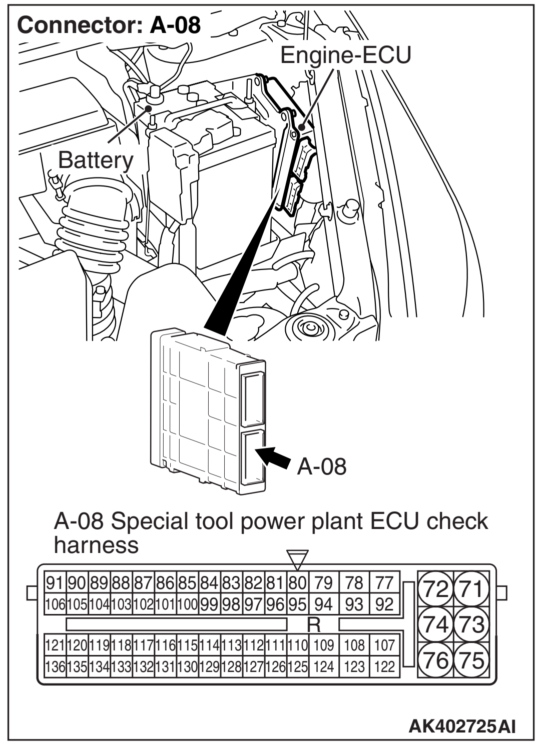
Q: Is the check result normal?

YES : Check and repair harness between B-53 (terminal No. 1) oxygen sensor (rear) connector and A-08 (terminal No. 97) engine-ECU connector.

- Check output line for open circuit and damage.

NO : Repair or replace the connector.

STEP 12. Connector check: A-08 engine-ECU connector



Q: Is the check result normal?

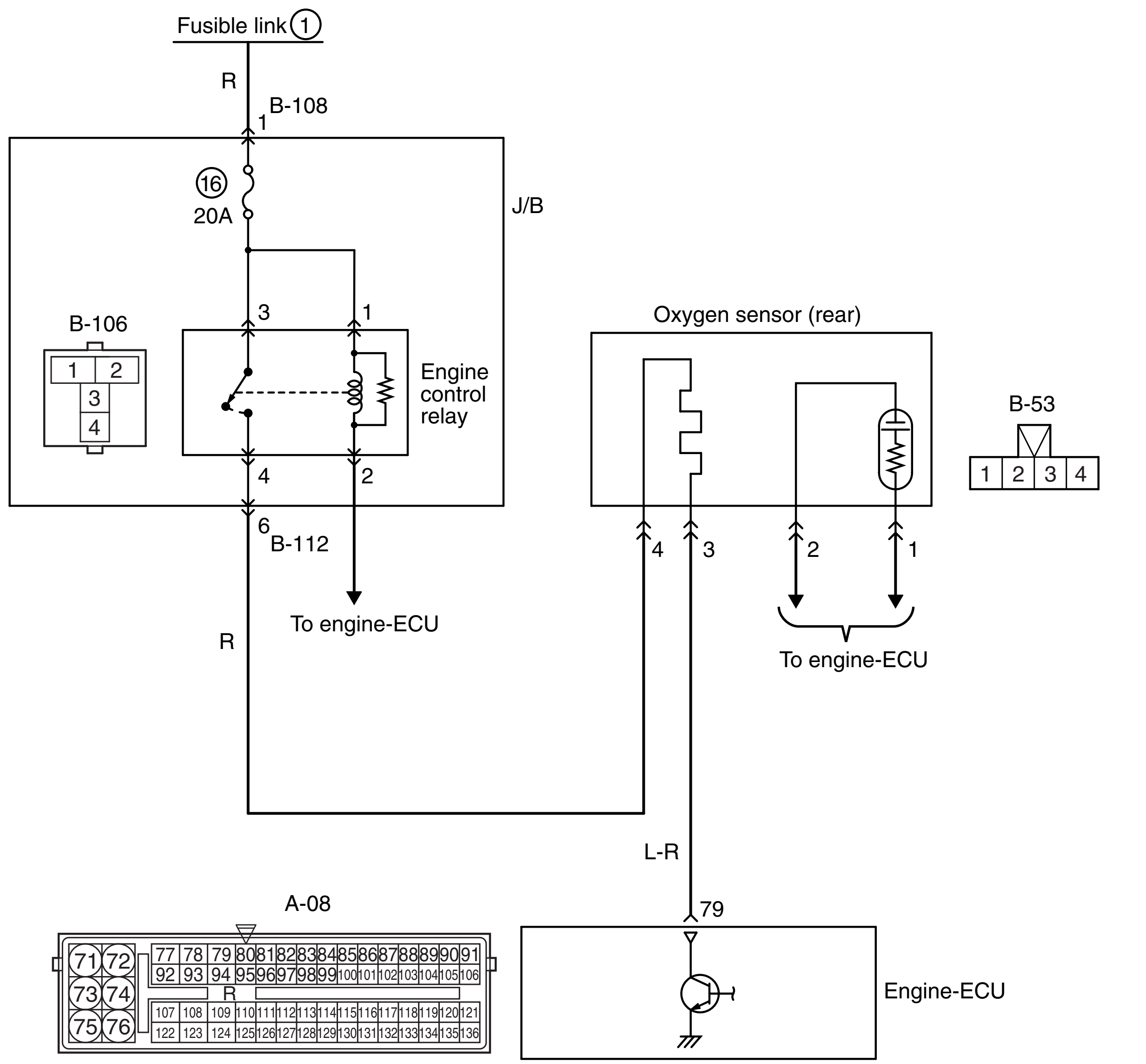
YES : Go to Step 6 .

NO : Repair or replace the connector.

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Code No. P0141: Oxygen Sensor (Rear) Heater System

Oxygen Sensor (rear) Heater Circuit



Wire colour code
B: Black LG: Light green G: Green L: Blue W: White Y: Yellow SB: Sky blue BR: Brown O: Orange GR: Gray
R: Red P: Pink V: Violet PU: Purple

AK403020AC

OPERATION

- Power is supplied to the heater power terminal (terminal No. 4) of the oxygen sensor (rear) connector from the engine control relay (terminal No. 4).
- The heater (terminal No. 3) of the oxygen sensor (rear) is controlled by the power transistor in the engine-ECU (terminal No. 79).

FUNCTION

- The power supply to the oxygen sensor (rear) heater is controlled by the ON/OFF control of the power transistor in the engine-ECU.
- Heating the oxygen sensor (rear) heater enables the oxygen sensor (rear) to provide good response even when the exhaust emission temperature is low.

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TROUBLE JUDGMENT

Check Conditions

- After engine starts
- Engine coolant temperature is more than 20°C.
- Battery voltage is more than 11 V and is less than 16 V.

Judgement Criterion

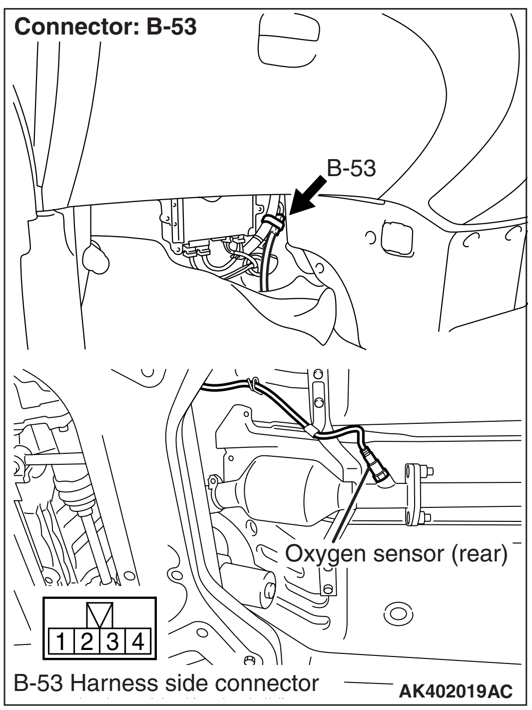
- For 4 seconds, oxygen sensor (rear) heater current is less than 0.16 A or more than 5.0 A.

PROBABLE CAUSES

- Failed oxygen sensor (rear) heater
- Open/short circuit and damage in oxygen sensor (rear) heater circuit or loose connector contact
- Failed engine-ECU

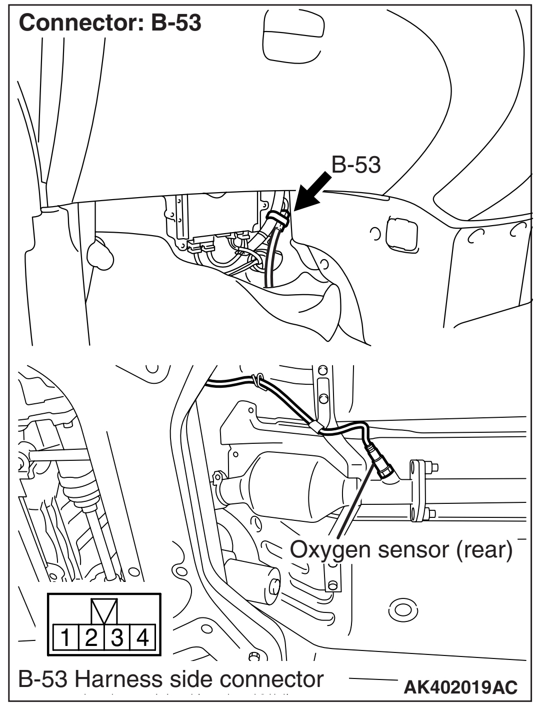
DIAGNOSIS PROCEDURE

STEP 1. Connector check: B-53 oxygen sensor (rear) connector



Q: Is the check result normal?
YES : Go to Step 2 .
NO : Repair or replace the connector.

STEP 2. Perform resistance measurement at B-53 oxygen sensor (rear) connector.

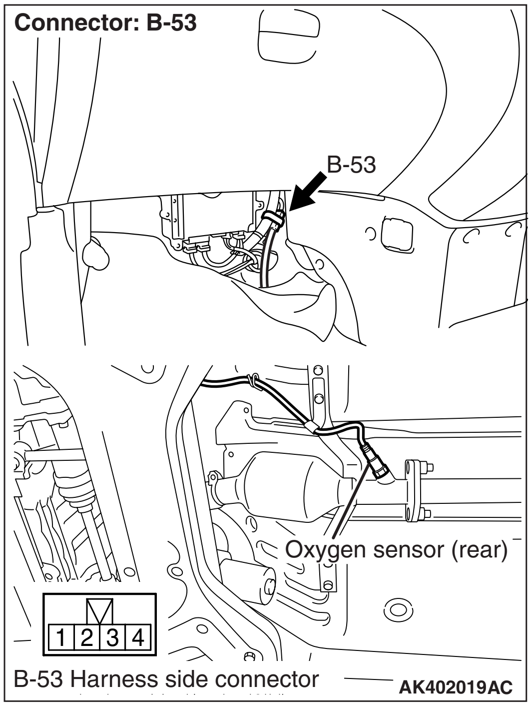


- Disconnect connector, and measure at sensor side.
- Resistance between terminal No. 3 and No. 4.

OK: 5 – 30 Ω (at 20°C)

Q: Is the check result normal?
YES : Go to Step 3 .
NO : Replace the oxygen sensor (rear).

STEP 3. Perform voltage measurement at B-53 oxygen sensor (rear) connector.



- Disconnect connector, and measure at harness side.
- Ignition switch: ON
- Voltage between terminal No. 4 and earth.

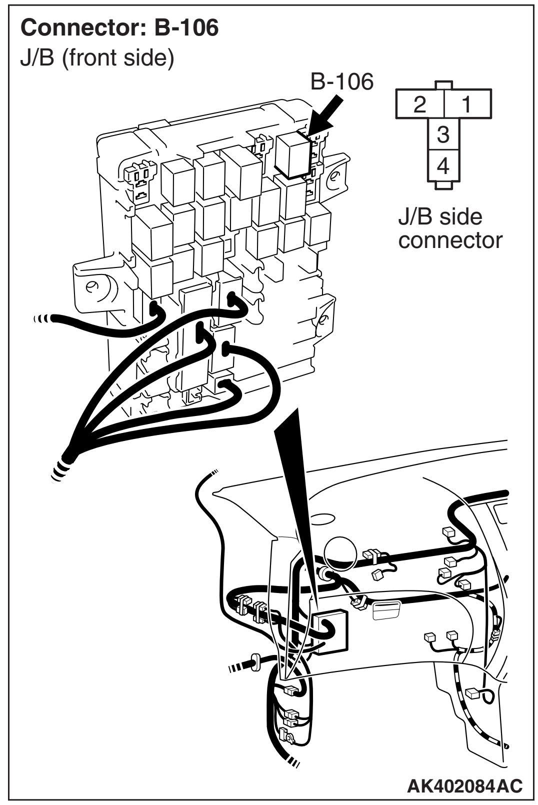
OK: System voltage

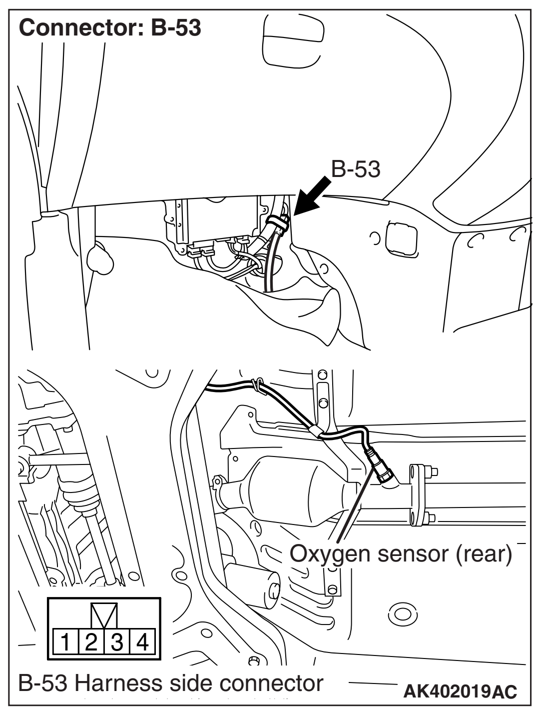
Q: Is the check result normal?

YES : Go to Step 5 .

NO : Go to Step 4 .

STEP 4. Connector check: B-106 engine control relay connector





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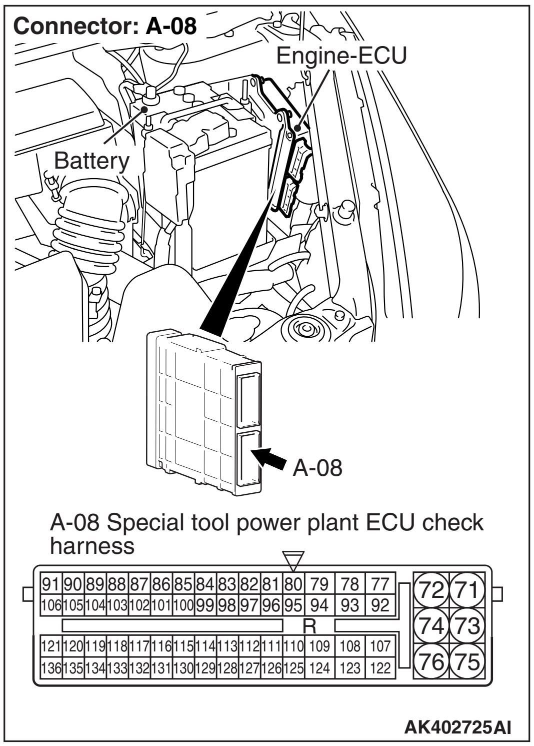
Q: Is the check result normal?

YES : Check intermediate connector B-112, and repair if necessary. If intermediate connector is normal, check and repair harness between B-53 (terminal No. 4) oxygen sensor (rear) connector and B-106 (terminal No. 4) engine control relay connector.

- Check power supply line for open/short circuit.

NO : Repair or replace the connector.

STEP 5. Perform voltage measurement at A-08 engine-ECU connector.



- Disconnect engine-ECU connector, and connect special tool power plant ECU check harness (MB991987), and then measure the voltage on the check connector.
- Ignition switch: ON
- Voltage between terminal No. 79 and earth.

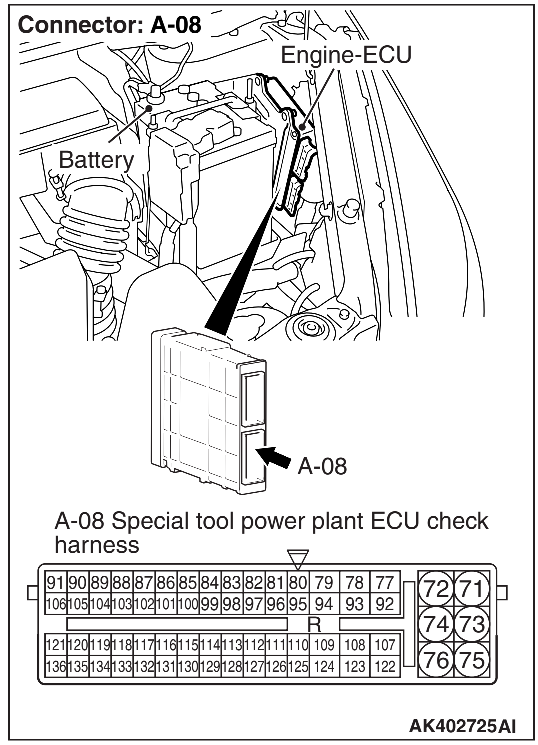
OK: System voltage

Q: Is the check result normal?

YES : Go to Step 8 .

NO : Go to Step 6 .

STEP 6. Connector check: A-08 engine-ECU connector

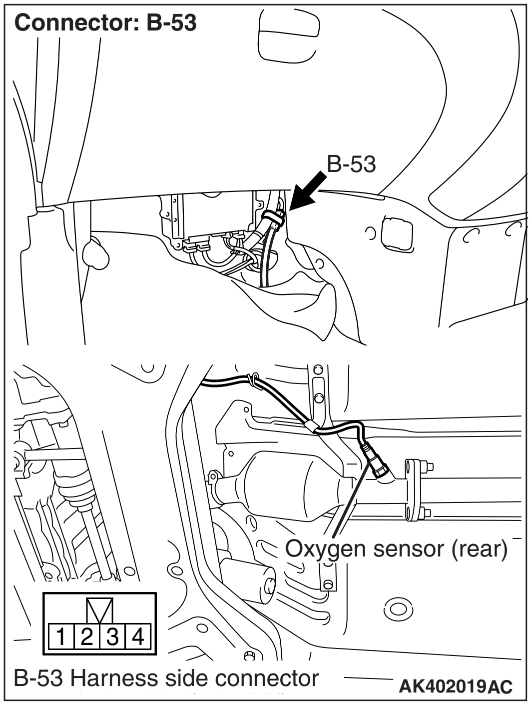


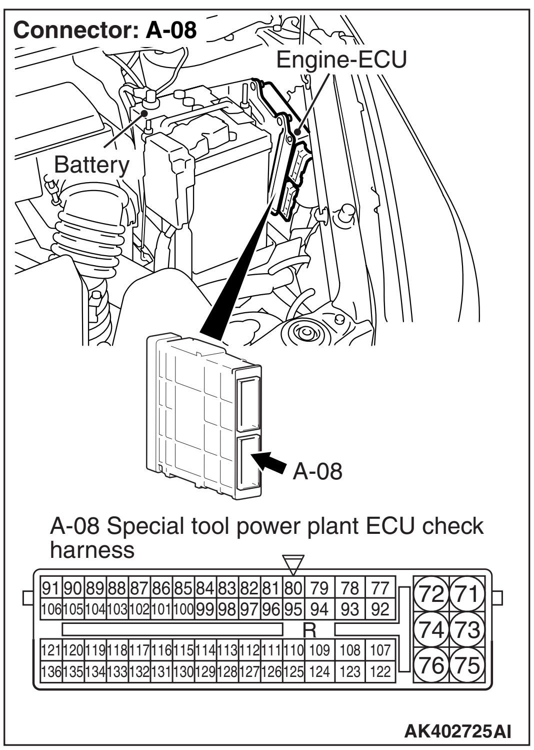
Q: Is the check result normal?

YES : Go to Step 7 .

NO : Repair or replace the connector.

STEP 7. Check harness between B-53 (terminal No. 3) oxygen sensor (rear) connector and A-08 (terminal No. 79) engine-ECU connector.





- Check earthing line for open/short circuit.

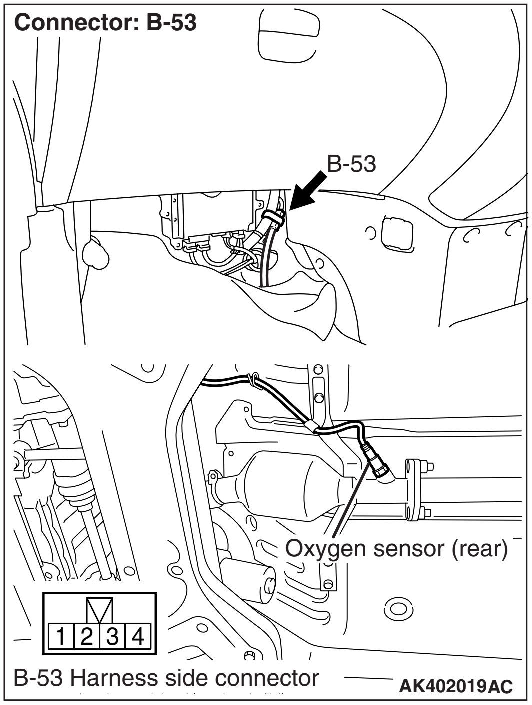
Q: Is the check result normal?
YES : Replace engine-ECU.
NO : Repair the damaged harness wire.

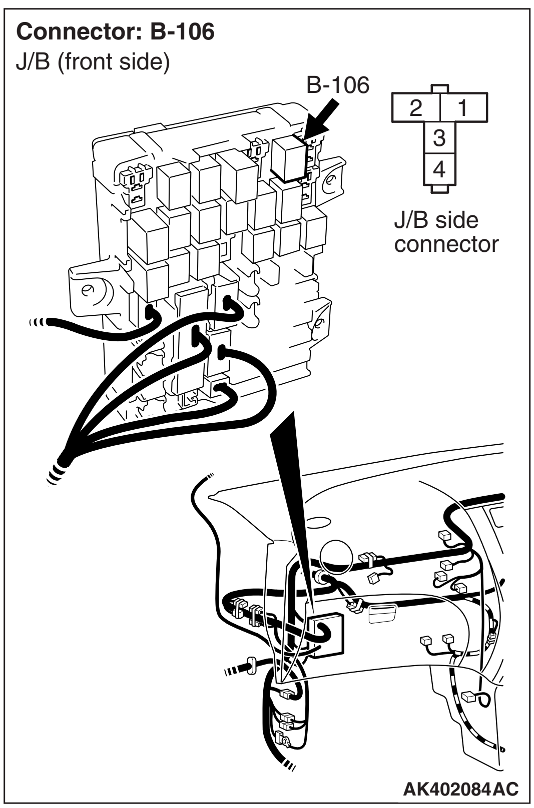
STEP 8. Connector check: A-08 engine-ECU connector

Q: Is the check result normal?
YES : Go to Step 9 .
NO : Repair or replace the connector.

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STEP 9. Check harness between B-53 (terminal No. 4) oxygen sensor (rear) connector and B-106 (terminal No. 4) engine control relay connector.





NOTE: Before checking harness, check intermediate connector B-112, and repair if necessary.

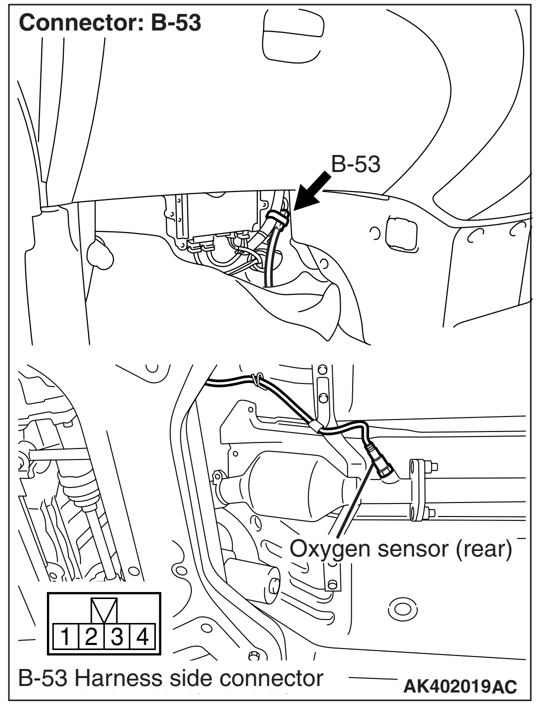
- Check power supply line for damage.

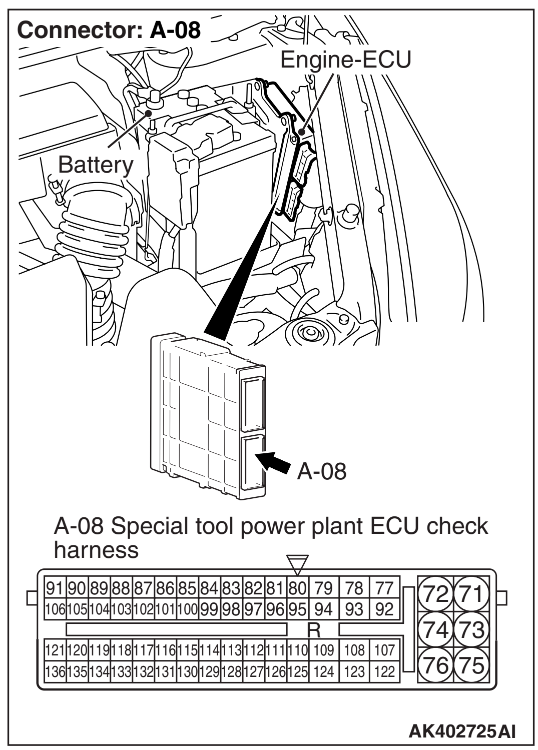
Q: Is the check result normal?

YES : Go to Step 10 .

NO : Repair the damaged harness wire.

STEP 10. Check harness between B-53 (terminal No. 3) oxygen sensor (rear) connector and A-08 (terminal No. 79) engine-ECU connector.





- Check earthing line for damage.

Q: Is the check result normal?

YES : Go to Step 11 .

NO : Repair the damaged harness wire.

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STEP 11. M.U.T.-III diagnosis code.

- Reconfirmation of diagnosis code.

Q: Is the diagnosis code set?

YES : Replace engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

Code No. P0170: Abnormal Fuel System

OPERATION

- Refer to Code No. P0201: No. 1 Injector System P.13B-92.
- Refer to Code No. P0202: No. 2 Injector System P.13B-97.
- Refer to Code No. P0203: No. 3 Injector System P.13B-102.
- Refer to Code No. P0204: No. 4 Injector System P.13B-107.

FUNCTION

- If the fuel system goes out of order, the fuel correction value will become larger.
- The engine-ECU checks whether the fuel correction value is within a specified range.

TROUBLE JUDGEMENT

Check Condition

- In learning air-fuel ratio

Judgement Criterion

- For more than 5 seconds, compensation value in fuel injection amount is too low.

Or

- For more than 5 seconds, compensation value in fuel injection amount is too high.

PROBABLE CAUSES

- Failed fuel supply system
- Failed oxygen sensor
- Failed intake air temperature sensor
- Failed engine coolant temperature sensor
- Failed air flow sensor
- Failed barometric pressure sensor
- Air drawn in from intake hose and inlet manifold
- Exhaust leak from exhaust manifold
- Failed throttle body (throttle valve area) fouled
- Failed injector
- Failed purge control solenoid valve
- Fuel pressure improper
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

Q: Is any other diagnosis code than P0170 output?

YES : Refer to Inspection Chart for Diagnosis Code P.13B-18.
NO : Go to Step 2.

STEP 2. M.U.T.-III data list

- Refer to Data List Reference Table P.13B-335.
  a. Item 12: Air flow sensor
  b. Item 13: Intake air temperature sensor
  c. Item 21: Engine coolant temperature sensor
  d. Item 25: Barometric pressure sensor

Q: Is the check result normal?

YES : Go to Step 3.
NO : Perform the diagnosis code classified check procedure on the sensor that has shown an abnormal data value (Refer to Inspection Chart for Diagnosis Code P.13B-18).

STEP 3. Check for ingress of air from intake hose and inlet manifold.

Q: Is the check result normal?

YES : Go to Step 4.
NO : Repair.

STEP 4. Check for leakage of exhaust emission from exhaust manifold.

Q: Is the check result normal?

YES : Go to Step 5.
NO : Repair.

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STEP 5. Check throttle body (throttle valve portion) for foul.

Q: Is the check result normal?

YES : Go to Step 6.
NO : Clean throttle body (throttle valve portion) (Refer to P.13B-358).

STEP 6. M.U.T.-III data list

- Refer to Data List Reference Table P.13B-335.
  a. Item 11: Oxygen sensor (front)

Q: Is the check result normal?

YES : Go to Step 7.
NO : Check oxygen sensor system (Refer to Code No. P0130 P.13B-65).

STEP 7. Check injector itself.

- Check injector itself (Refer to P.13B-367).

Q: Is the check result normal?

YES : Go to Step 8.
NO : Replace injector.

STEP 8. Check purge control solenoid valve itself.

- Check purge control solenoid valve itself (Refer to GROUP 17 – Emission Control System – Evaporative Emission Control System – Purge Control Solenoid Valve P.17-16).

Q: Is the check result normal?

YES : Go to Step 9.
NO : Replace purge control solenoid valve.

STEP 9. Fuel pressure measurement

- Fuel pressure measurement (Refer to P.13B-358).

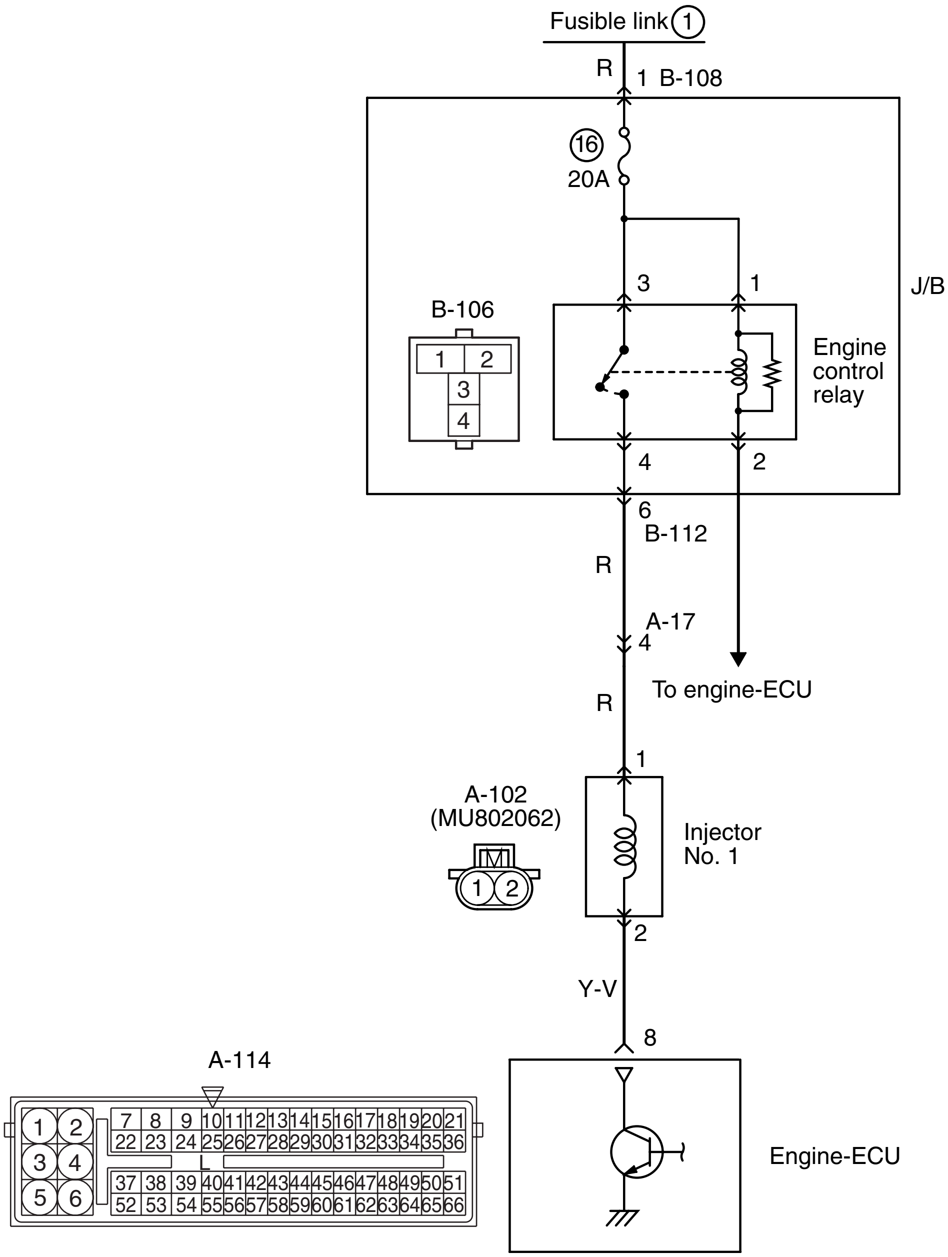
Q: Is the check result normal?

YES : Replace engine-ECU.
NO : Repair.

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Group TOC

Code No. P0201: No. 1 injector System

No. 1 Injector Circuit



Wire colour code
B: Black LG: Light green G: Green L: Blue W: White Y: Yellow SB: Sky blue BR: Brown O: Orange GR: Gray
R: Red P: Pink V: Violet P: Purple

AK402684AN

OPERATION

- Power is supplied to the injector (terminal No. 1) through the engine control relay (terminal No. 4).
- The engine-ECU (terminal No. 8) turns on the power transistor in the unit to activate the injector (terminal No. 2).

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Group TOC

FUNCTION

- The engine-ECU controls the injector activation time.
- The fuel injection amount from the injector depends on the injector activation time.

TROUBLE JUDGEMENT

Check Conditions

- Engine speed is more than 50 r/min and is less than 1,000 r/min.
- Throttle position sensor (main) output voltage is less than 1.0 V.
- Not during fuel cut or forced injector-driving (actuator test)

Judgement Criterion

- Injector coil surge voltage (battery voltage plus 2 V) is not detected for 4 seconds.

PROBABLE CAUSES

- Failed No. 1 injector
- Open/short circuit or damage in No. 1 injector circuit, or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III actuator test

- Item 01: No. 1 injector

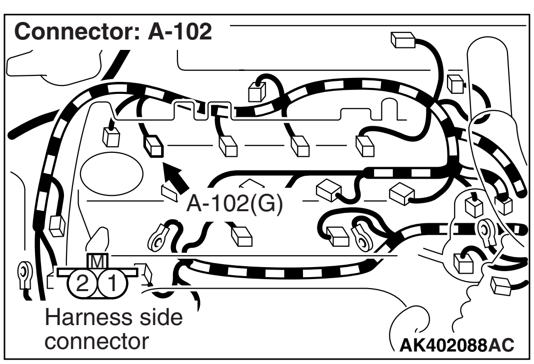
OK: Idling state varies.

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

NO : Go to Step 2 .

STEP 2. Connector check: A-102 injector connector

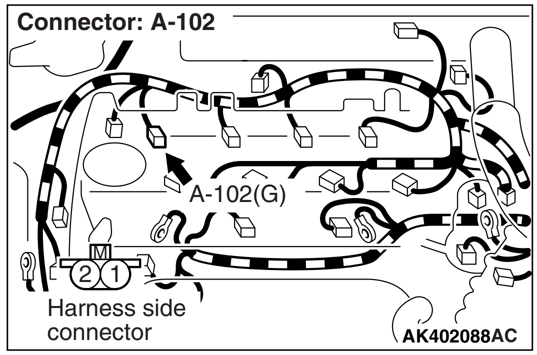


Q: Is the check result normal?

YES : Go to Step 3 .

NO : Repair or replace.

STEP 3. Perform resistance measurement at A-102 injector connector.



- Disconnect connector, and measure at injector side.
- Resistance between terminals No. 1 and No. 2.

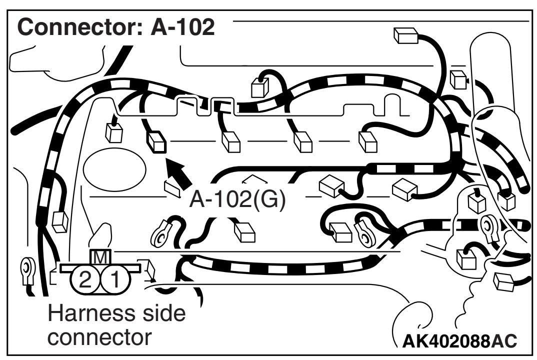
OK: 10.5 – 13.5 Ω (at 20°C)

Q: Is the check result normal?

YES : Go to Step 4 .

NO : Replace No. 1 injector.

STEP 4. Perform voltage measurement at A-102 injector connector.



- Disconnect connector and measure at harness side.
- Ignition switch: ON
- Voltage between terminal No. 1 and earth.

OK: System voltage

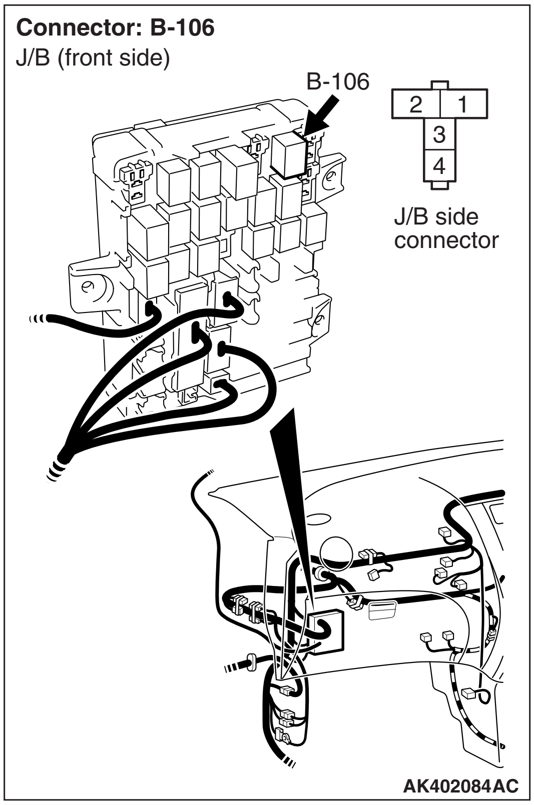
Q: Is the check result normal?

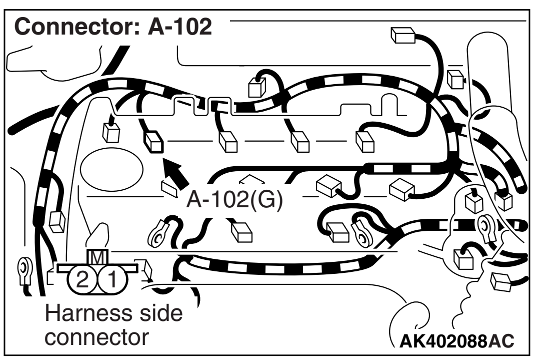
YES : Go to Step 6 .

NO : Go to Step 5 .

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STEP 5. Connector check: B-106 engine control relay connector





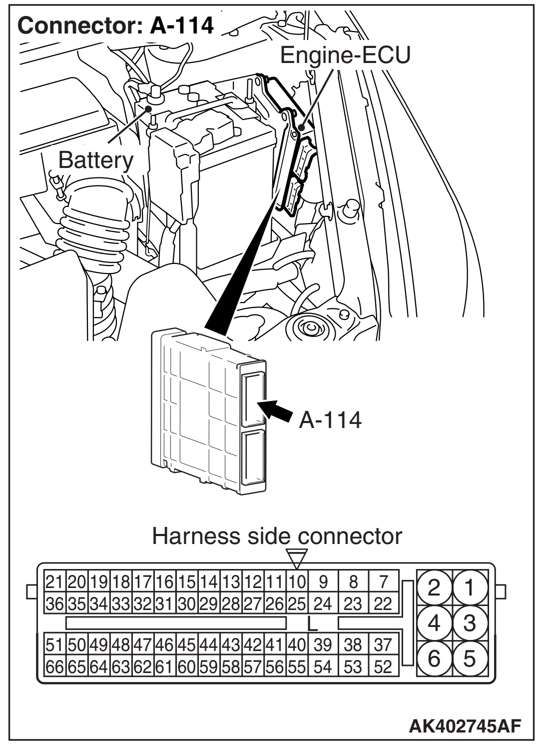
Q: Is the check result normal?

YES : Check intermediate connectors A-17 and B-112 and repair if necessary. If intermediate connectors are normal, check and repair harness between B-106 (terminal No. 4) engine control relay connector and A-102 (terminal No.1) injector connector.

- Check power supply line for open/short circuit.

NO : Repair or replace.

STEP 6. Connector check: A-114 engine-ECU connector



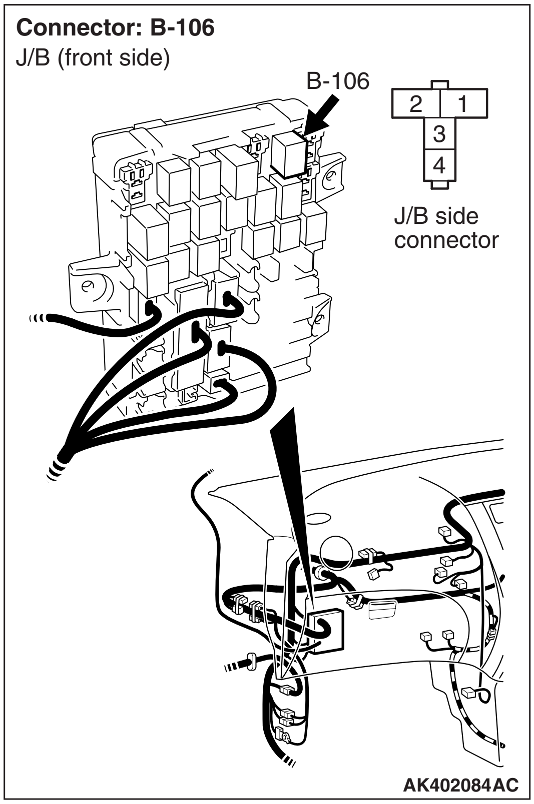
Q: Is the check result normal?

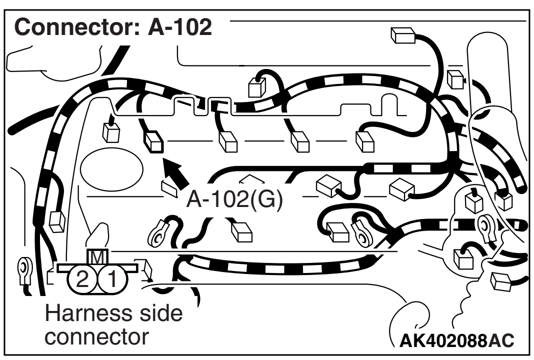
YES : Go to Step 7 .

NO : Repair or replace.

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Group TOC

STEP 7. Check harness between B-106 (terminal No. 4) engine control relay connector and A-102 (terminal No. 1) injector connector.





NOTE: Before checking harness, check intermediate connectors A-17 and B-112, and repair if necessary.

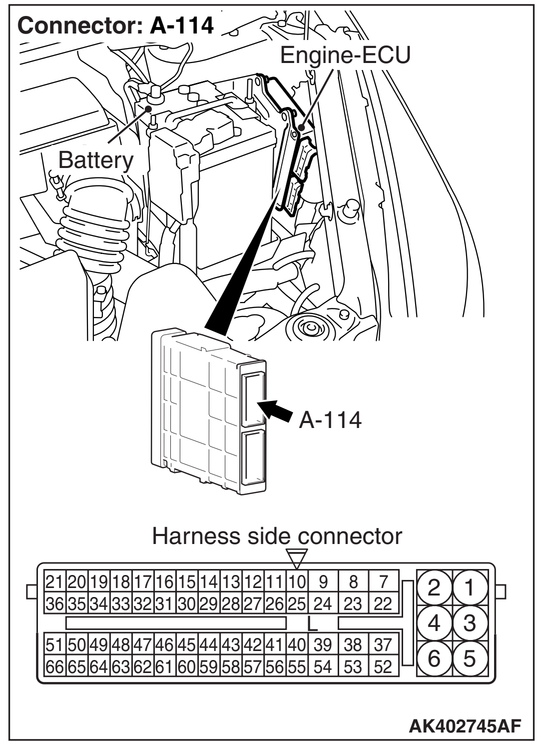
- Check power supply line for damage.

Q: Is the check result normal?

YES : Go to Step 8 .

NO : Repair.

STEP 8. Connector check: A-114 engine-ECU connector



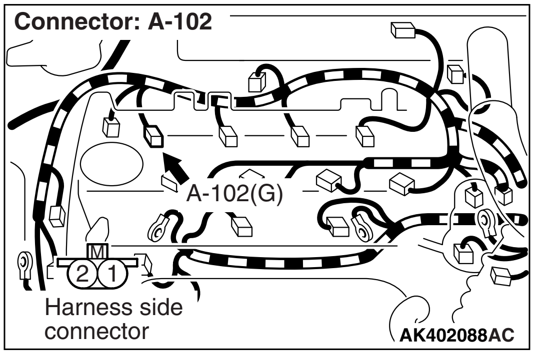
Q: Is the check result normal?

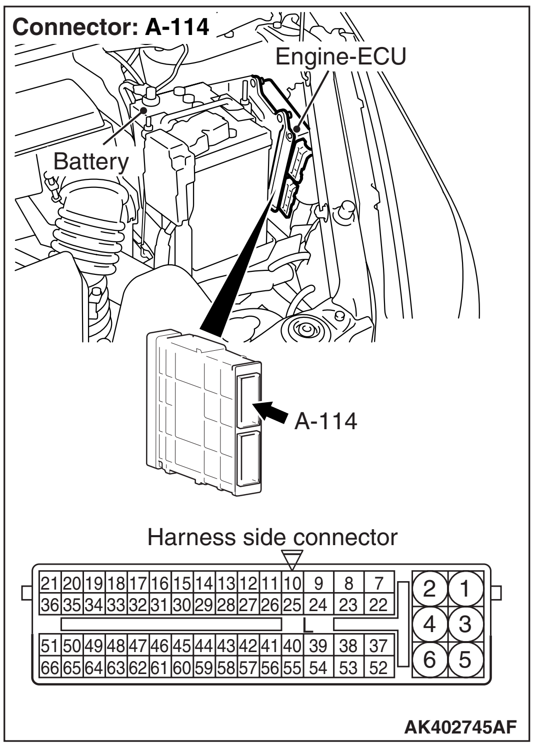
YES : Go to Step 9 .

NO : Repair or replace.

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Group TOC

STEP 9. Check harness between A-102 (terminal No. 2) injector connector and A-114 (terminal No. 8) engine-ECU connector.





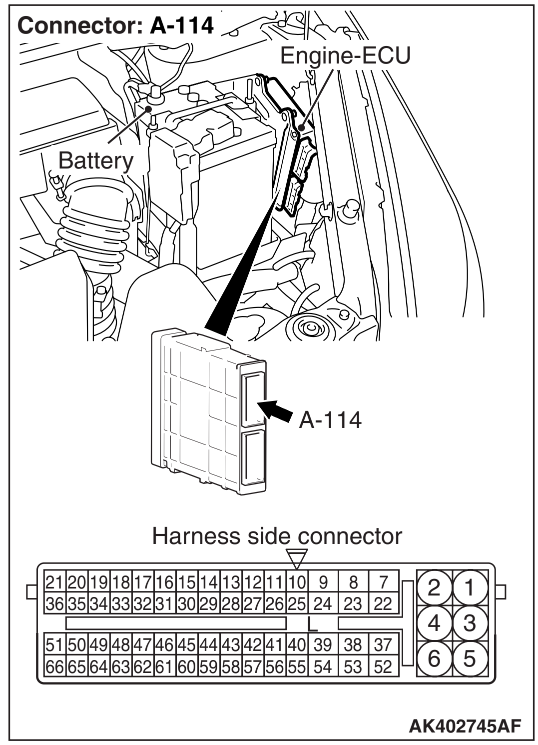
- Check output line for open/short circuit and damage.

Q: Is the check result normal?

YES : Go to Step 10 .

NO : Repair.

STEP 10. Perform signal wave pattern measurement at A-114 engine-ECU connector (using an oscilloscope).



- Disconnect engine-ECU connector, and connect special tool power plant ECU check harness (MB991987) and measure the voltage on the check connector.
- Engine: Idling
- Transmission: P range
- Voltage between terminal No. 8 and earth.

OK: Waveforms as shown in Inspection Procedure with Oscilloscope (Refer to P.13B-352) should be displayed.

Q: Is the check result normal?

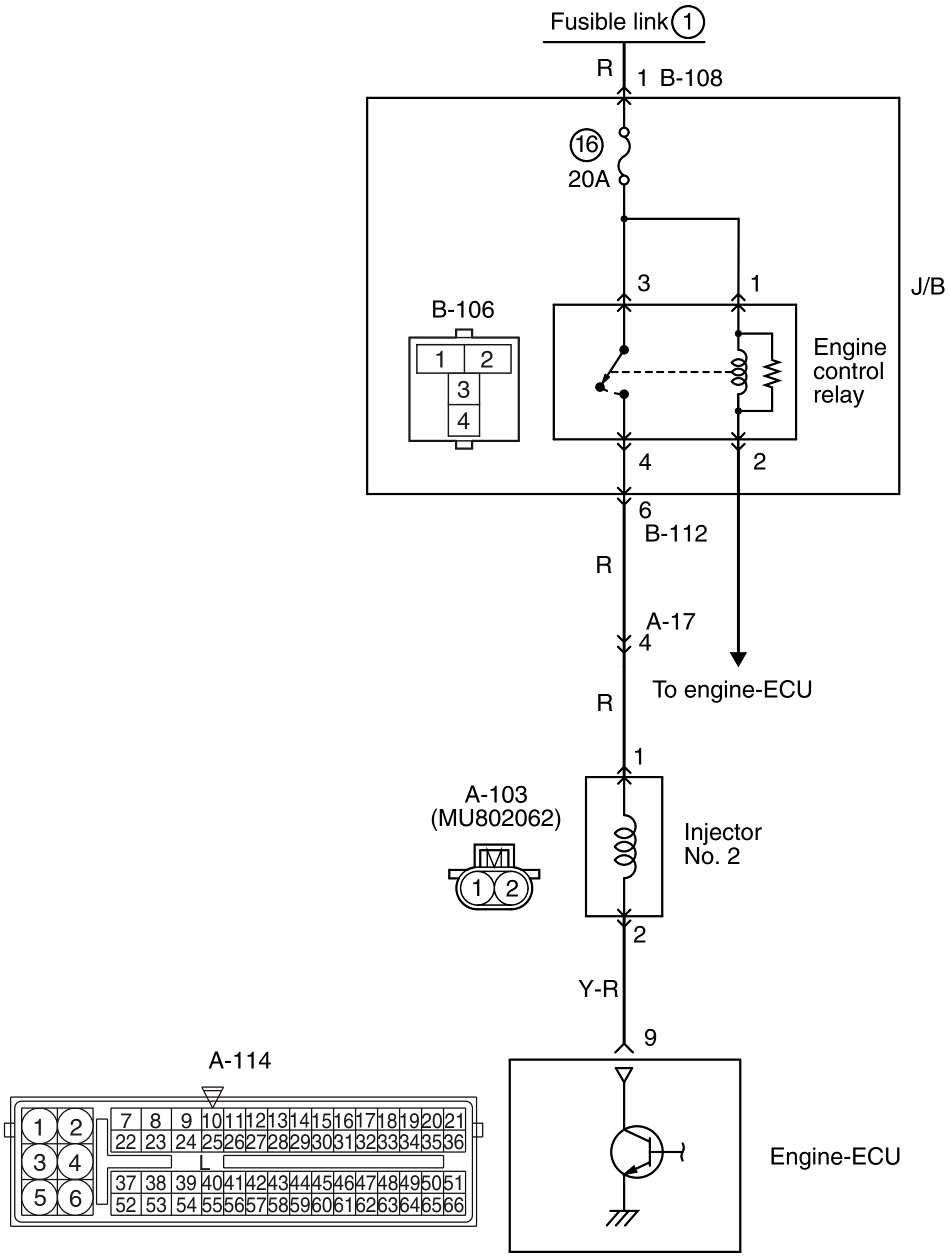
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

NO : Replace engine-ECU.

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Group TOC

Code No. P0202: No. 2 Injector System

No. 2 Injector Circuit



Wire colour code
B: Black LG: Light green G: Green L: Blue W: White Y: Yellow SB: Sky blue BR: Brown O: Orange GR: Gray
R: Red P: Pink V: Violet P: Purple

AK402684AO

OPERATION

- Power is supplied to the injector (terminal No. 1) through the engine control relay (terminal No. 4).
- The engine-ECU (terminal No. 9) turns on the power transistor in the unit to activate the injector (terminal No. 2).

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Group TOC

FUNCTION

- The engine-ECU controls the injector activation time.
- The fuel injection amount from the injector depends on the injector activation time.

TROUBLE JUDGEMENT

Check Conditions

- Engine speed is more than 50 r/min and is less than 1,000 r/min.
- Throttle position sensor (main) output voltage is less than 1.0 V.
- Not during fuel cut or forced injector-driving (actuator test)

Judgement Criterion

- Injector coil surge voltage (battery voltage plus 2 V) is not detected for 4 seconds.

PROBABLE CAUSES

- Failed No. 2 injector
- Open/short circuit or damage in No. 2 injector circuit, or loose connect contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1 M.U.T.-III actuator test

- Item 02: No. 2 injector

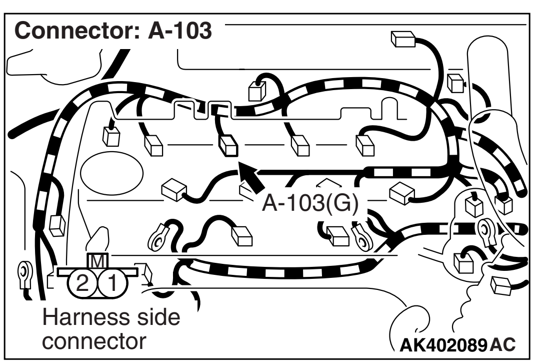
OK: Idling state varies.

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

NO : Go to Step 2 .

STEP 2. Connector check: A-103 injector connector

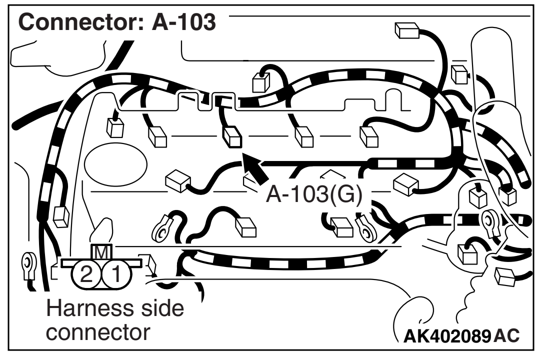


Q: Is the check result normal?

YES : Go to Step 3 .

NO : Repair or replace.

STEP 3. Perform resistance measurement at A-103 injector connector.



- Disconnect connector, and measure at injector side.
- Resistance between terminals No. 1 and No. 2.

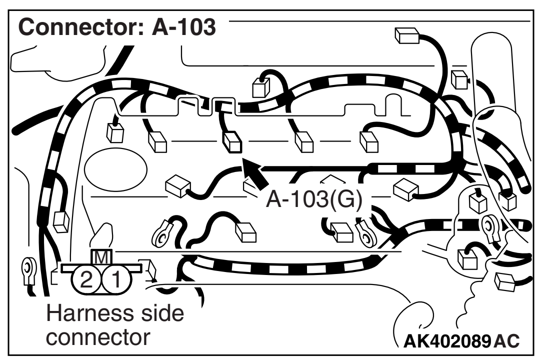
OK: 10.5 – 13.5 Ω (at 20°C)

Q: Is the check result normal?

YES : Go to Step 4 .

NO : Replace No. 2 injector.

STEP 4. Perform voltage measurement at A-103 injector connector.



- Disconnect connector and measure at harness side.
- Ignition switch: ON
- Voltage between terminal No. 1 and earth.

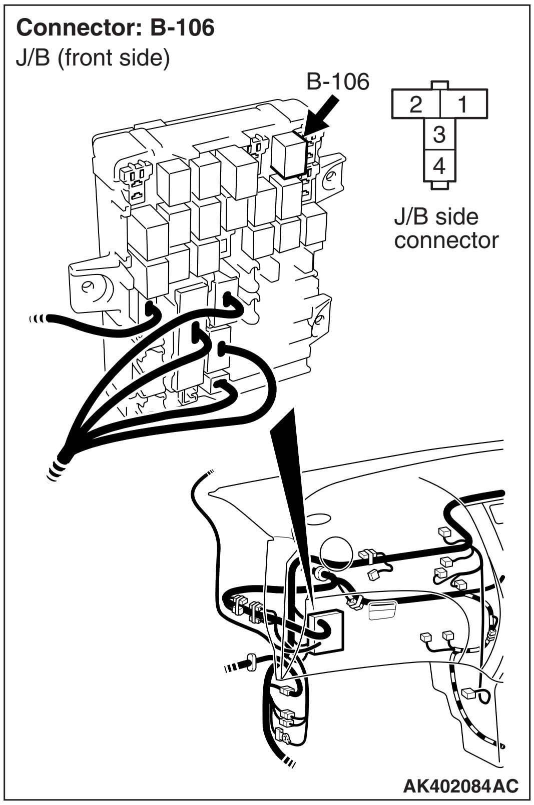
OK: System voltage

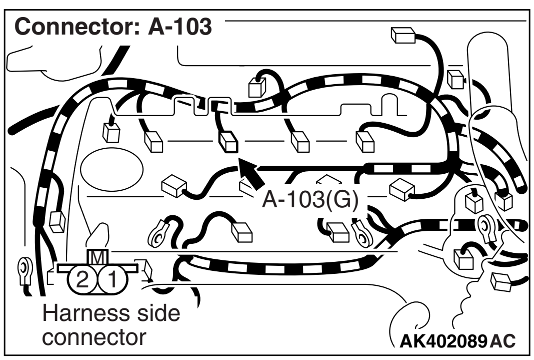
Q: Is the check result normal?

YES : Go to Step 6 .

NO : Go to Step 5 .

STEP 5. Connector check: B-106 engine control relay connector





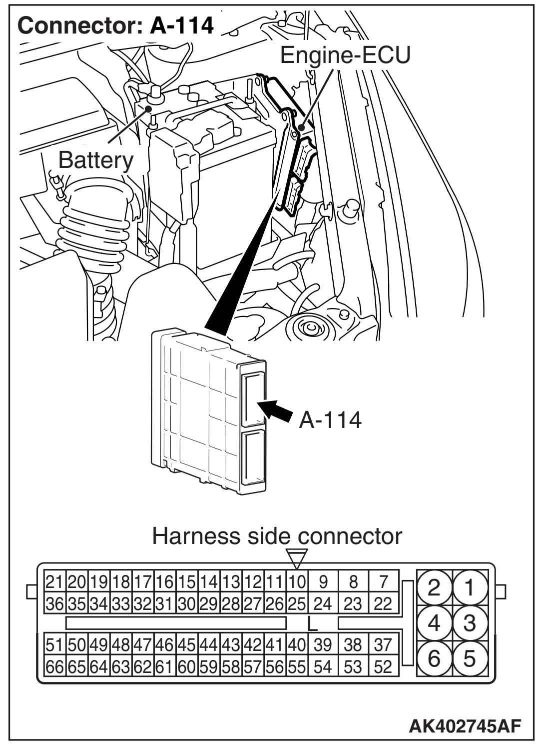
Q: Is the check result normal?

YES : Check intermediate connectors A-17 and B-112 and repair if necessary. If intermediate connectors are normal, check and repair harness between B-106 (terminal No. 4) engine control relay connector and A-103 (terminal No. 1) injector connector.

- Check power supply line for open/short circuit.

NO : Repair or replace.

STEP 6. Connector check: A-114 engine-ECU connector



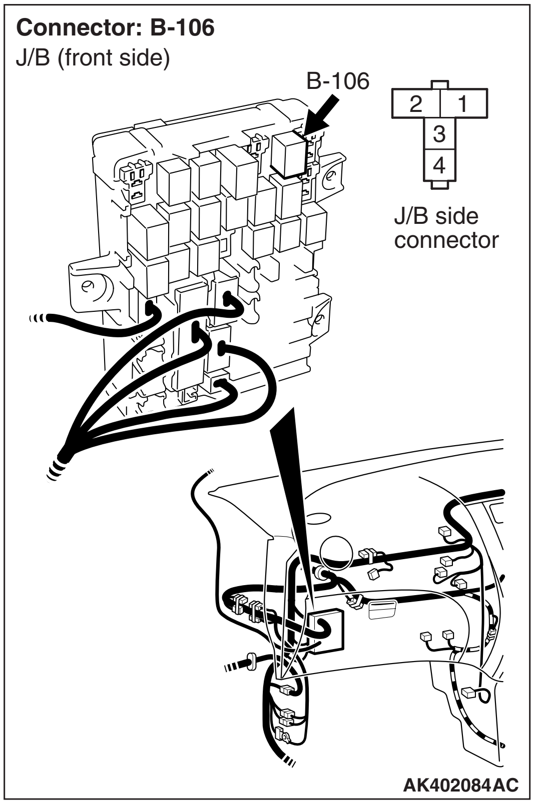
Q: Is the check result normal?

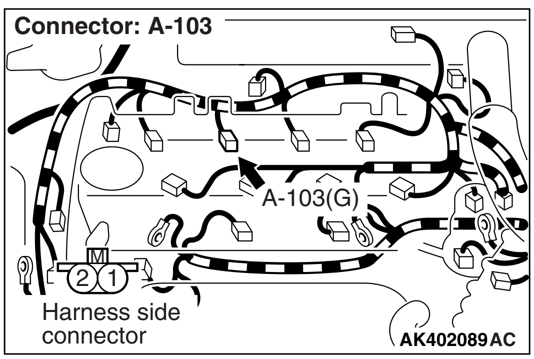
YES : Go to Step 7 .

NO : Repair or replace.

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STEP 7. Check harness between B-106 (terminal No. 4) engine control relay connector and A-103 (terminal No. 1) injector connector.



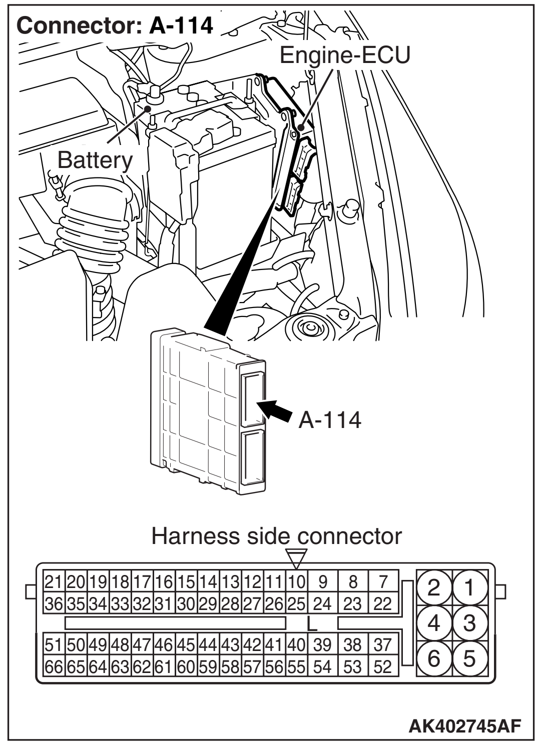


NOTE: Before checking harness, check intermediate connectors A-17 and B-112, and repair if necessary.

- Check power supply line for damage.

Q: Is the check result normal?
YES : Go to Step 8 .
NO : Repair.

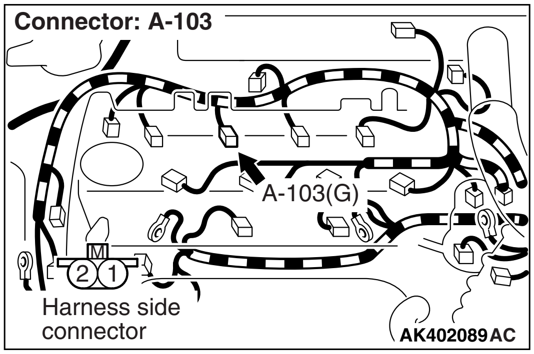
STEP 8. Connector check: A-114 engine-ECU connector

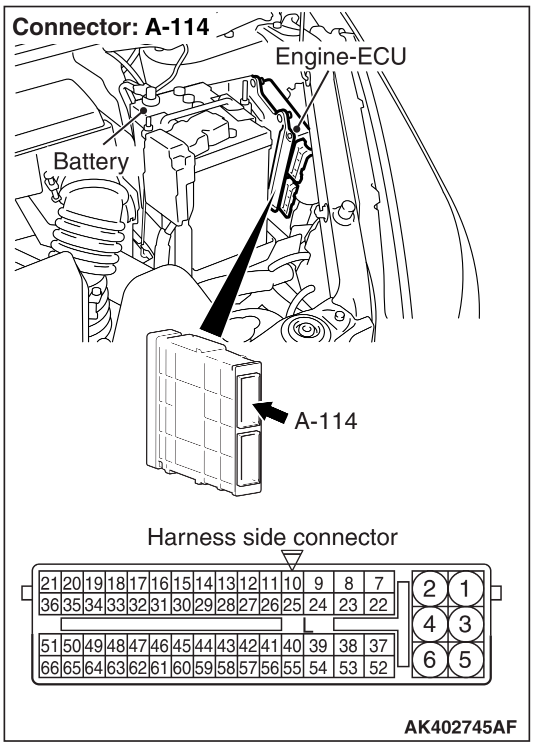


Q: Is the check result normal?
YES : Go to Step 9 .
NO : Repair or replace.

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STEP 9. Check harness between A-103 (terminal No. 2) injector connector and A-114 (terminal No. 9) engine-ECU connector.





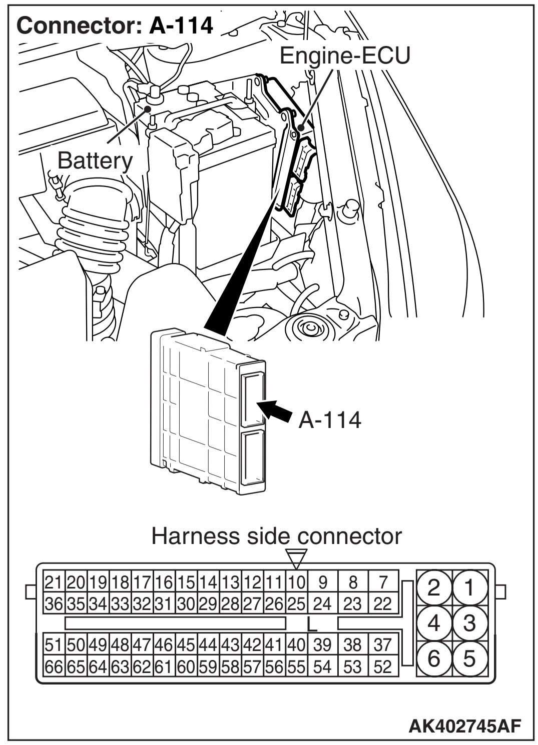
- Check output line for open/short circuit and damage.

Q: Is the check result normal?

YES : Go to Step 10 .

NO : Repair.

STEP 10. Perform signal wave pattern measurement at A-114 engine-ECU connector (using an oscilloscope).



- Disconnect engine-ECU connector, connect special tool power plant ECU check harness (MB991987) and measure voltage on check connector.
- Engine: Idling
- Transmission: Neutral
- Voltage between terminal No. 9 and earth.

OK: Waveforms as shown in the Inspection Procedure with Oscilloscope (Refer to P.13B-352) should be displayed.

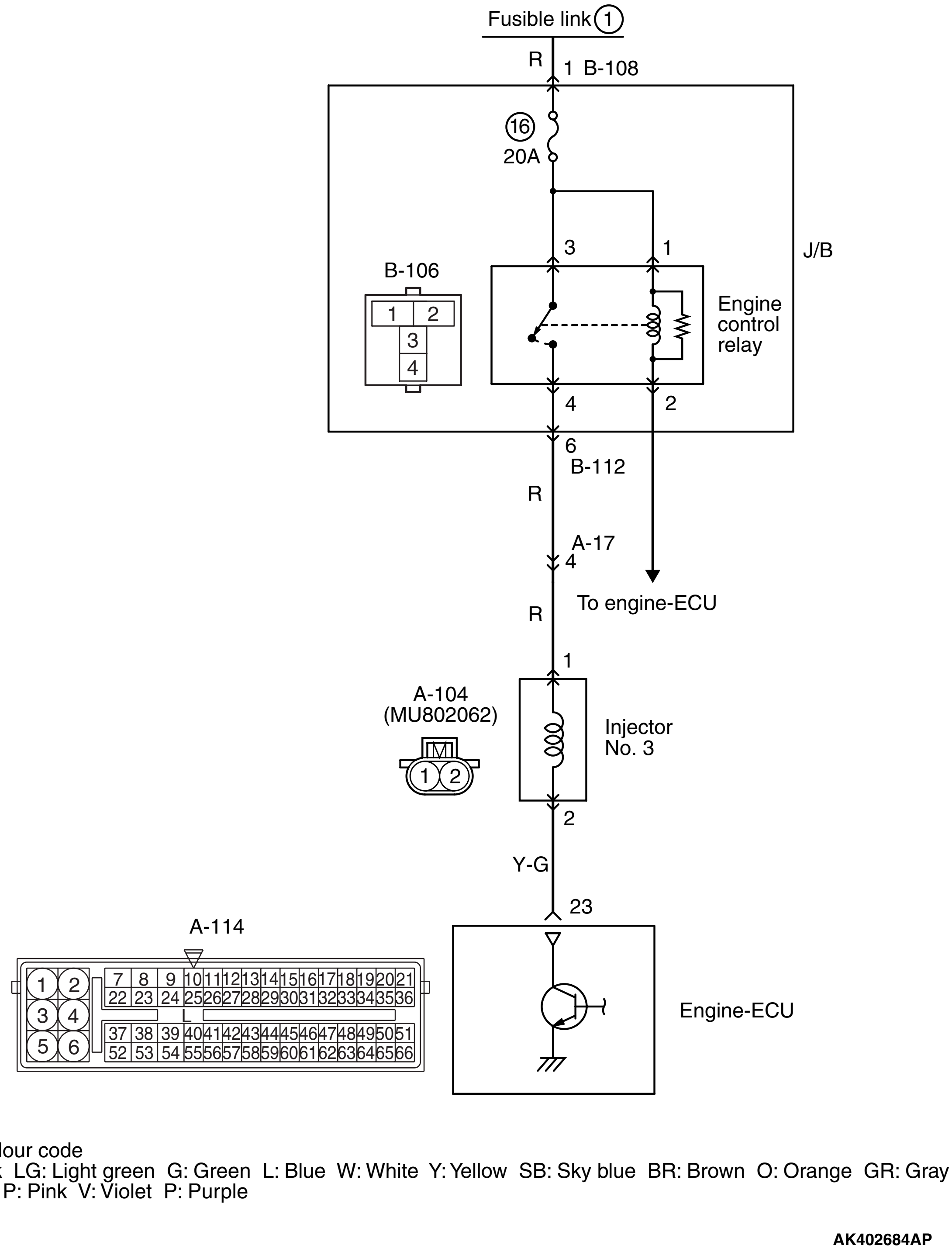
Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

NO : Replace engine-ECU.

Code No. P0203: No. 3 Injector System

No. 3 Injector Circuit



OPERATION

- Power is supplied to the injector (terminal No. 1) through the engine control relay (terminal No. 4).
- The engine-ECU (terminal No. 23) turns on the power transistor in the unit to activate the injector (terminal No. 2).

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Group TOC

FUNCTION

- The engine-ECU controls the injector activation time.
- The fuel injection amount from the injector depends on the injector activation time.

TROUBLE JUDGEMENT

Check Conditions

- Engine speed is more than 50 r/min and is less than 1,000 r/min.
- Throttle position sensor (main) output voltage is less than 1.0 V.
- Not during fuel cut or forced injector-driving (actuator test)

Judgement Criterion

- Injector coil surge voltage (battery voltage plus 2 V) is not detected for 4 seconds.

PROBABLE CAUSES

- Failed No. 3 injector
- Open/short circuit or damage in No. 3 injector circuit, or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III actuator test

- Item 03: No. 3 injector

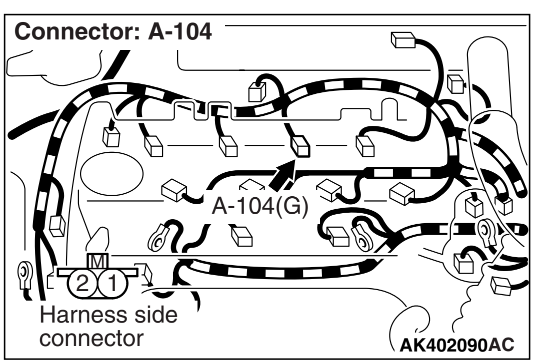
OK: Idling state varies.

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

NO : Go to Step 2 .

STEP 2. Connector check: A-104 injector connector

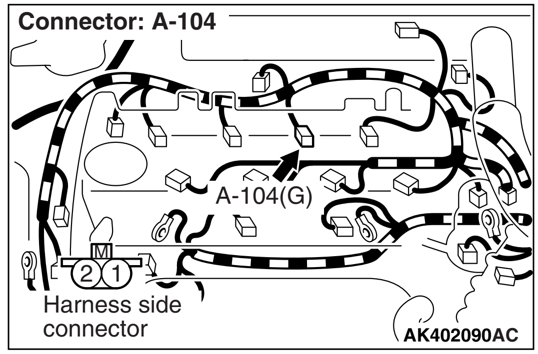


Q: Is the check result normal?

YES : Go to Step 3 .

NO : Repair or replace.

STEP 3. Perform resistance measurement at A-104 injector connector.



- Disconnect connector, and measure at injector side.
- Resistance between terminals No. 1 and No. 2.

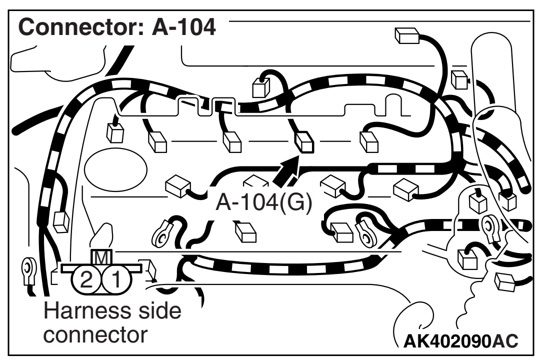
OK: 10.5 – 13.5 Ω (at 20°C)

Q: Is the check result normal?

YES : Go to Step 4 .

NO : Replace No. 3 injector.

STEP 4. Perform voltage measurement at A-104 injector connector.



- Disconnect connector and measure at harness side.
- Ignition switch: ON
- Voltage between terminals No. 1 and earth.

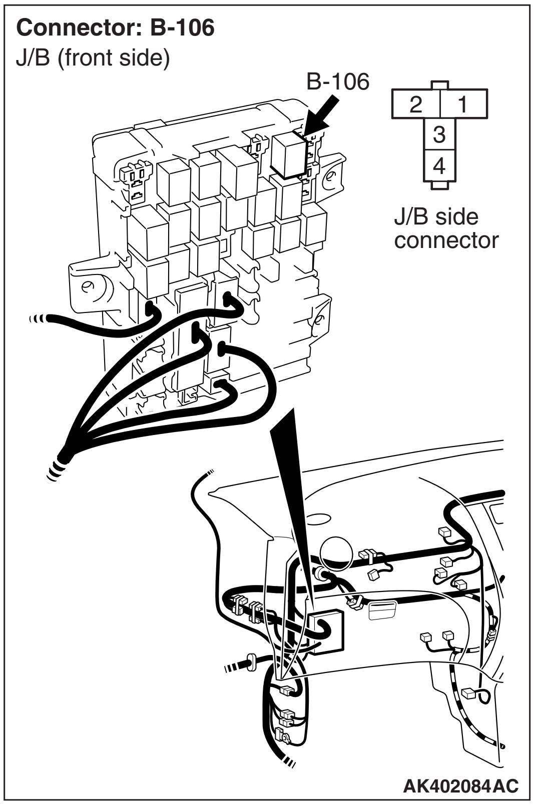
OK: System voltage

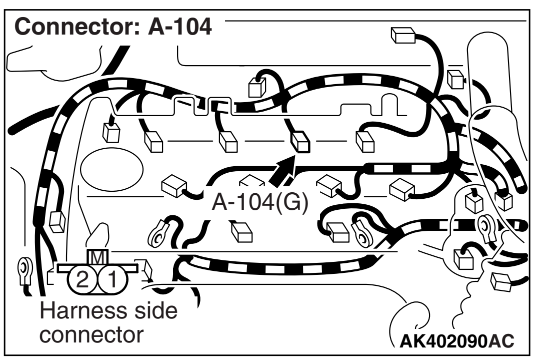
Q: Is the check result normal?

YES : Go to Step 6 .

NO : Go to Step 5 .

STEP 5. Connector check: B-106 engine control relay connector





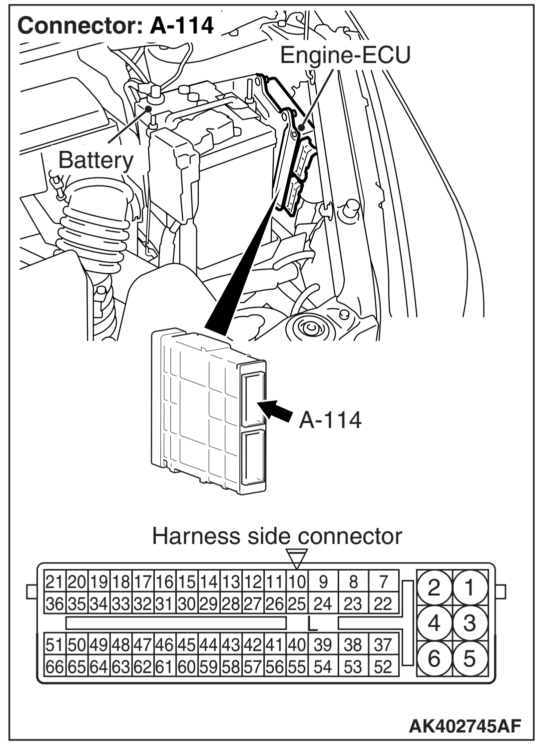
Q: Is the check result normal?

YES : Check intermediate connectors A-17 and B-112 and repair if necessary. If intermediate connectors are normal, check and repair harness between B-106 (terminal No. 4) engine control relay connector and A-104 (terminal No. 1) injector connector.

- Check power supply line for open/short circuit.

NO : Repair or replace.

STEP 6. Connector check: A-114 engine-ECU connector



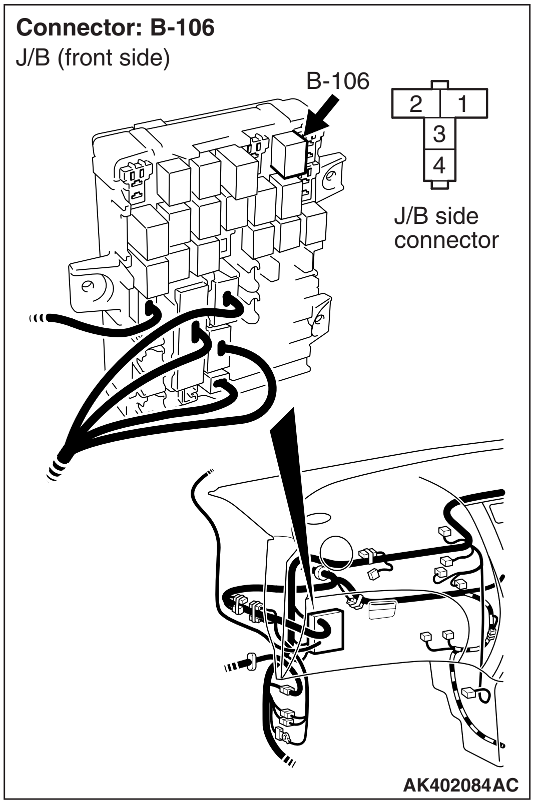
Q: Is the check result normal?

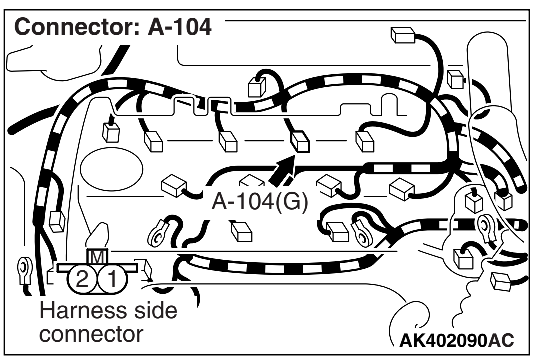
YES : Go to Step 7 .

NO : Repair or replace.

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STEP 7. Check harness between B-106 (terminal No. 4) engine control relay connector and A-104 (terminal No. 1) injector connector.





NOTE: Before checking harness, check intermediate connectors A-17 and B-112, and repair if necessary.

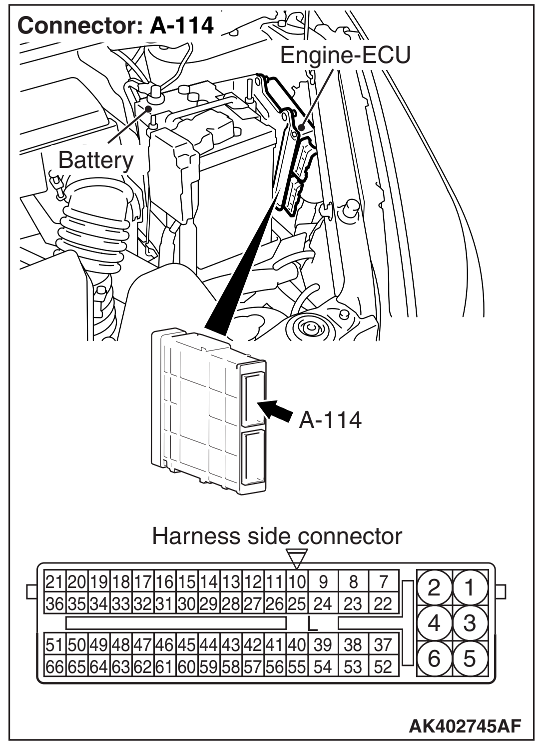
- Check power supply line for damage.

Q: Is the check result normal?

YES : Go to Step 8 .

NO : Repair.

STEP 8. Connector check: A-114 engine-ECU connector



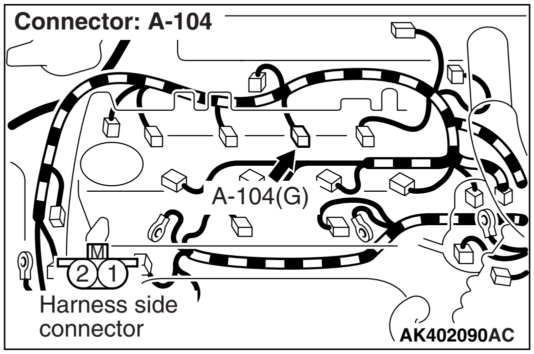
Q: Is the check result normal?

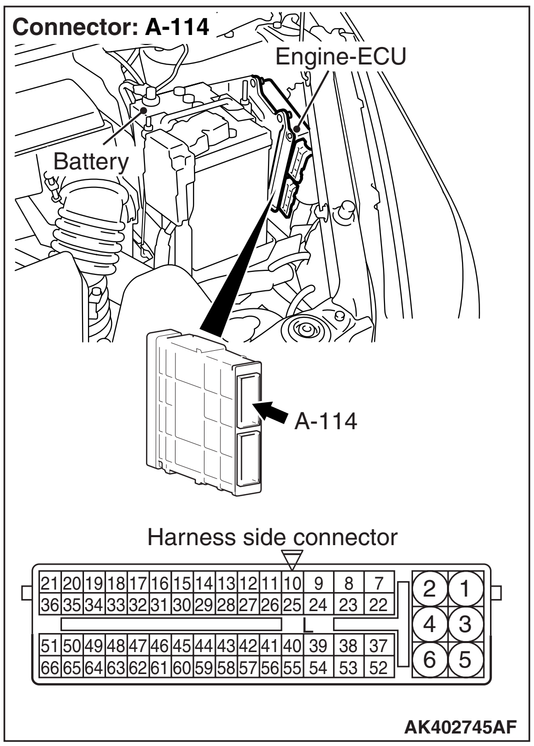
YES : Go to Step 9 .

NO : Repair or replace.

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STEP 9. Check harness between A-104 (terminal No. 2) injector connector and A-114 (terminal No. 23) engine-ECU connector.



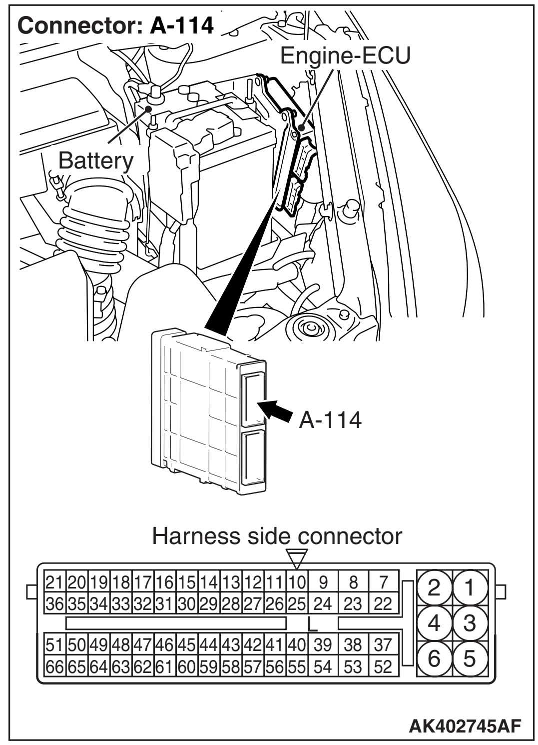


- Check output line for open/short circuit and damage.

Q: Is the check result normal?

YES : Go to Step 10 .
NO : Repair.

STEP 10. Perform signal wave pattern measurement at A-114 engine-ECU connector (using an oscilloscope).



- Disconnect engine-ECU connector, and connect special tool power plant ECU check harness (MB991987) and measure the voltage on the check connector.
- Engine: Idling
- Transmission: Neutral
- Voltage between terminal No. 23 and earth.

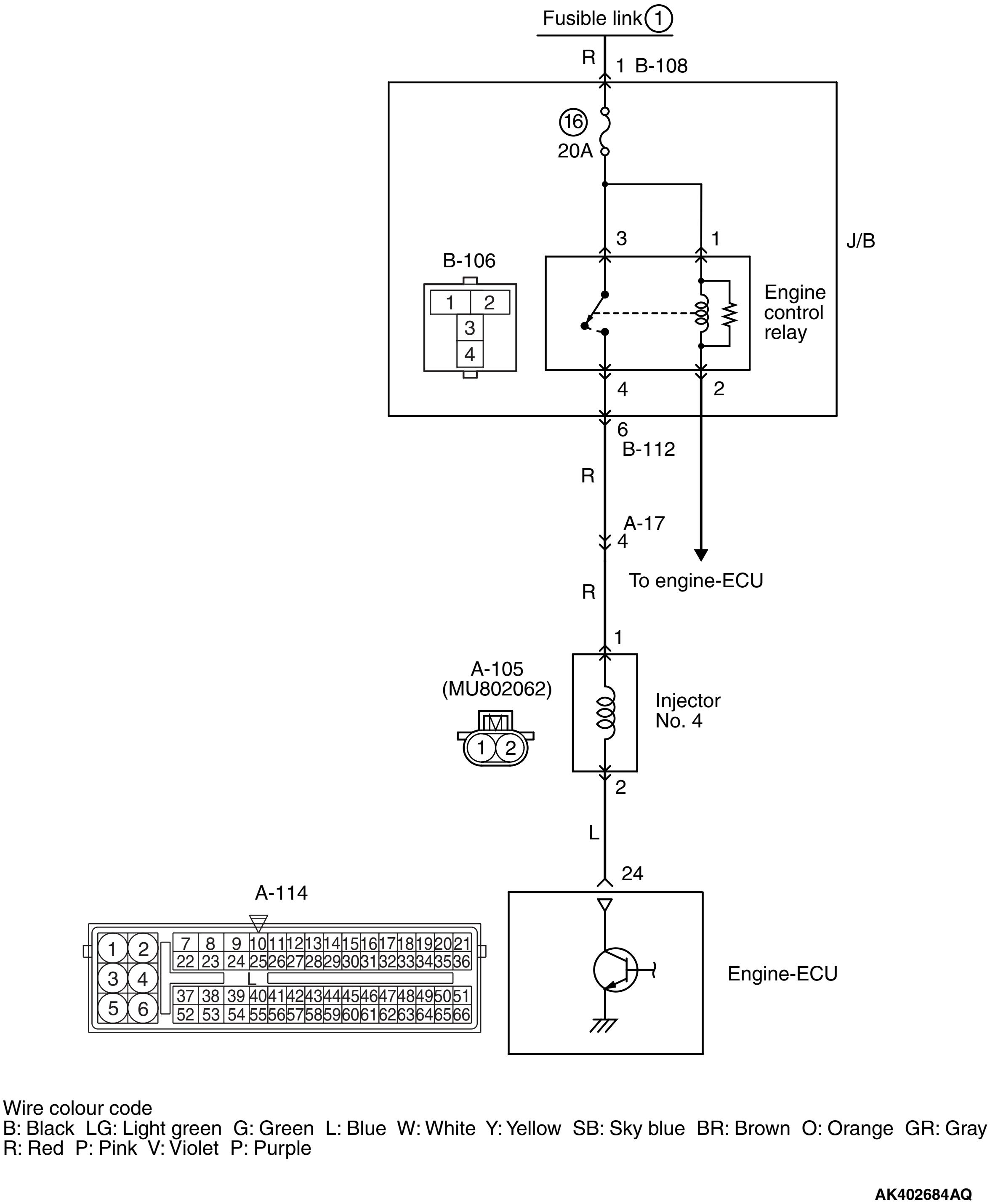
OK: Waveform as shown in Inspection Procedure with Oscilloscope (Refer to P.13B-352) should be displayed.

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).
NO : Replace engine-ECU.

Code No. P0204: No. 4 Injector System

No. 4 Injector Circuit



OPERATION

- Power is supplied to the injector (terminal No. 1) through the engine control relay (terminal No. 4).
- The engine-ECU (terminal No. 24) turns on the power transistor in the unit to activate the injector (terminal No. 2).

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FUNCTION

- The engine-ECU controls the injector activation time.
- The fuel injection amount from the injector depends on the injector activation time.

TROUBLE JUDGEMENT

Check Conditions

- Engine speed is more than 50 r/min and is less than 1,000 r/min.
- Throttle position sensor (main) output voltage is less than 1.0 V.
- Not during fuel cut or forced injector-driving (actuator test)

Judgement Criterion

- Injector coil surge voltage (battery voltage plus 2 V) is not detected for 4 seconds.

PROBABLE CAUSES

- Failed No. 4 injector
- Open/short circuit or damage in No. 4 injector circuit, or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III actuator test

- Item 04: No. 4 injector

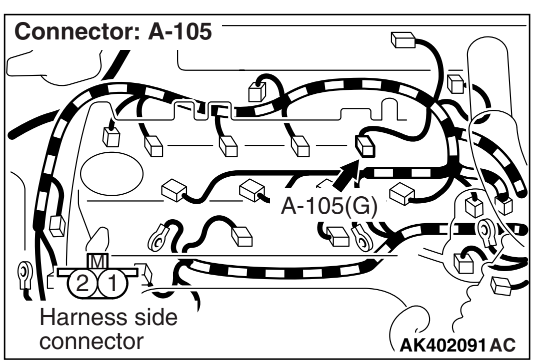
Idling state varies.

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

NO : Go to Step 2 .

STEP 2. Connector check: A-105 injector connector

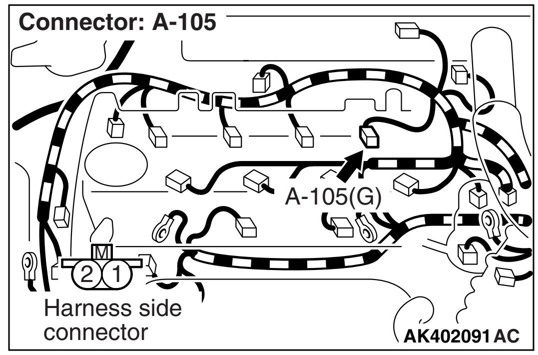


Q: Is the check result normal?

YES : Go to Step 3 .

NO : Repair or replace.

STEP 3. Perform resistance measurement at A-105 injector connector.



- Disconnect connector, and measure at injector side.
- Resistance between terminals No. 1 and No. 2.

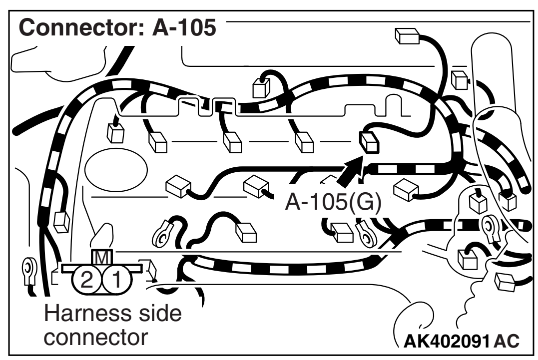
OK: 10.5 – 13.5 Ω (at 20°C)

Q: Is the check result normal?

YES : Go to Step 4 .

NO : Replace No. 4 injector.

STEP 4. Perform voltage measurement at A-105 injector connector.



- Disconnect connector and measure at harness side.
- Ignition switch: ON
- Voltage between terminal No. 1 and earth.

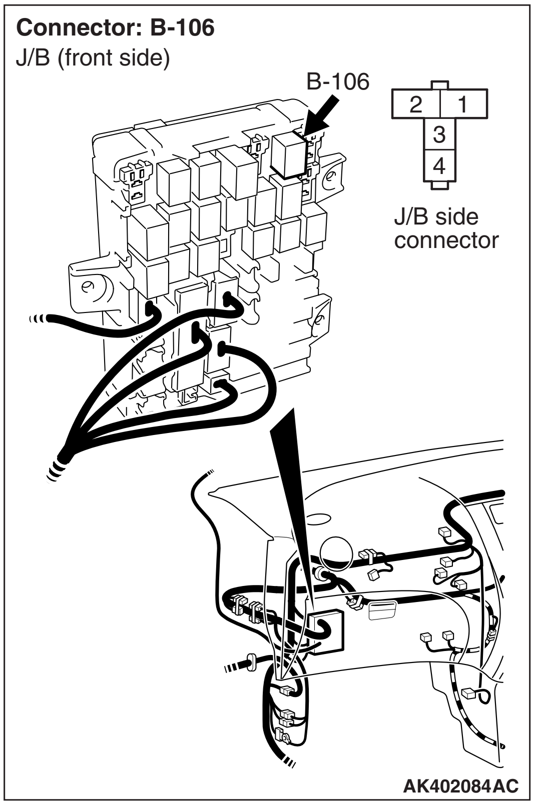
OK: System voltage

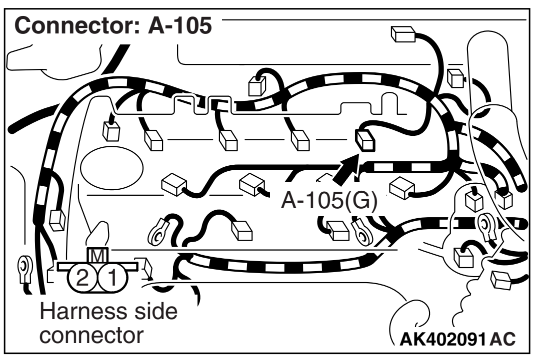
Q: Is the check result normal?

YES : Go to Step 6 .

NO : Go to Step 5 .

STEP 5. Connector check: B-106 engine control relay connector





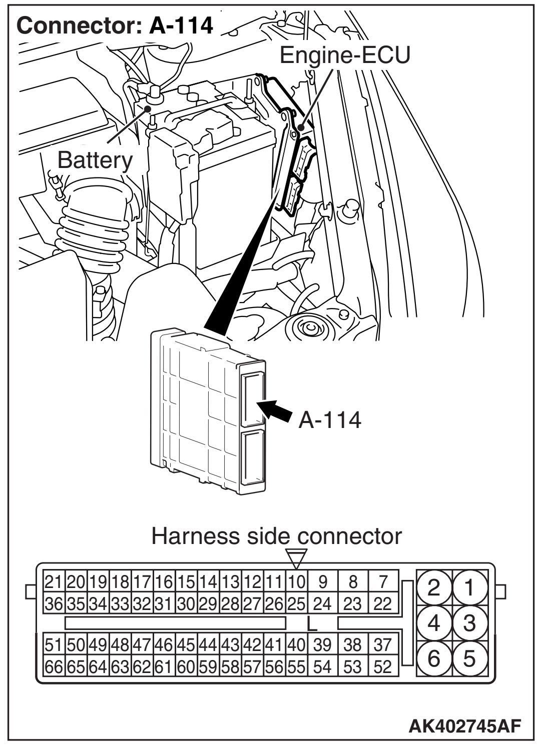
Q: Is the check result normal?

YES : Check intermediate connectors A-17 and B-112 and repair if necessary. If intermediate connectors are normal, check and repair harness between B-106 (terminal No. 4) engine control relay connector and A-105 (terminal No. 1) injector connector.

- Check power supply line for open/short circuit.

NO : Repair or replace.

STEP 6. Connector check: A-114 engine-ECU connector

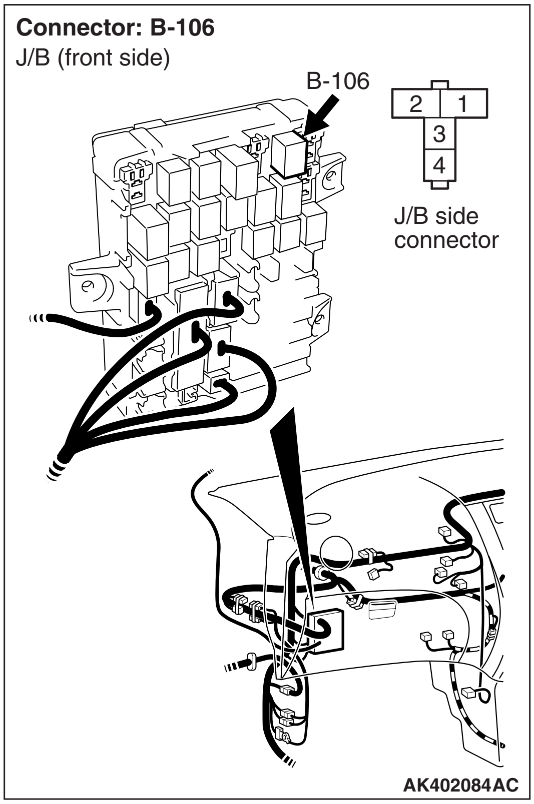


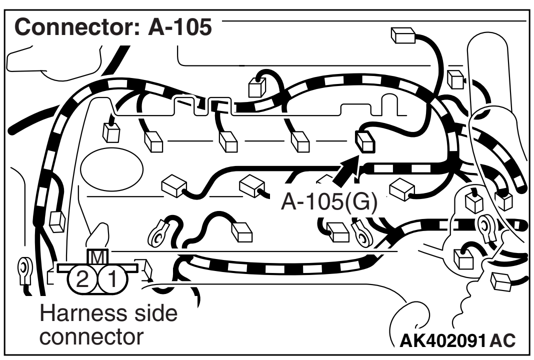
Q: Is the check result normal?

YES : Go to Step 7 .

NO : Repair or replace.

STEP 7. Check harness between B-106 (terminal No. 4) engine control relay connector and A-105 (terminal No. 1) injector connector.





NOTE: Before checking harness, check intermediate connectors A-17 and B-112, and repair if necessary.

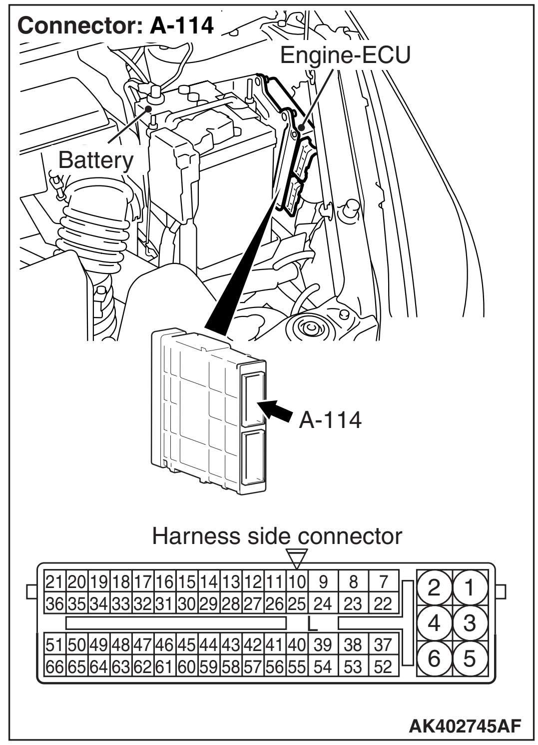
- Check power supply line for damage.

Q: Is the check result normal?

YES : Go to Step 8 .

NO : Repair.

STEP 8. Connector check: A-114 engine-ECU connector



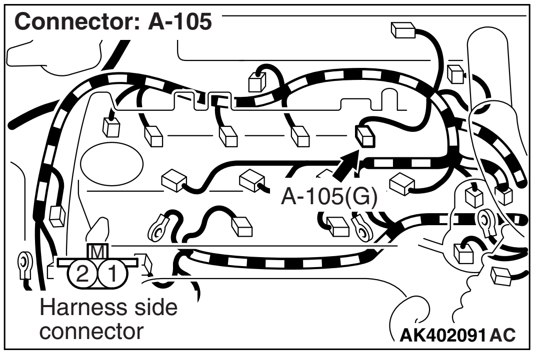
Q: Is the check result normal?

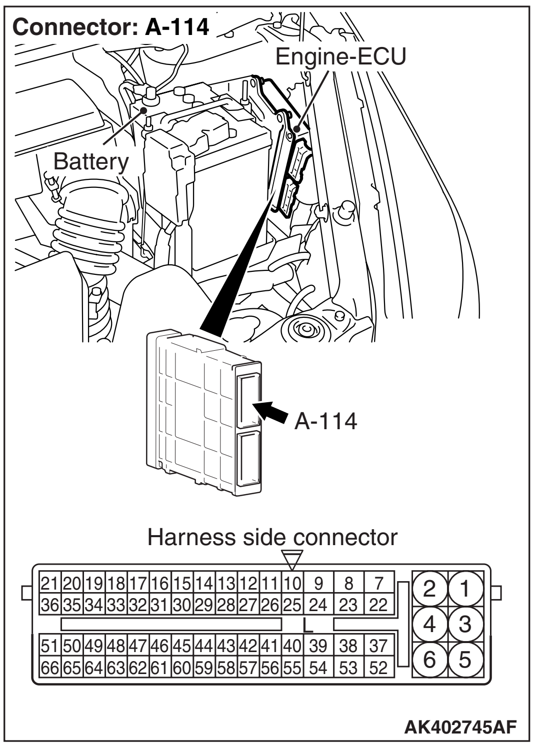
YES : Go to Step 9 .

NO : Repair or replace.

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STEP 9. Check harness between A-105 (terminal No. 2) injector connector and A-114 (terminal No. 24) engine-ECU connector.





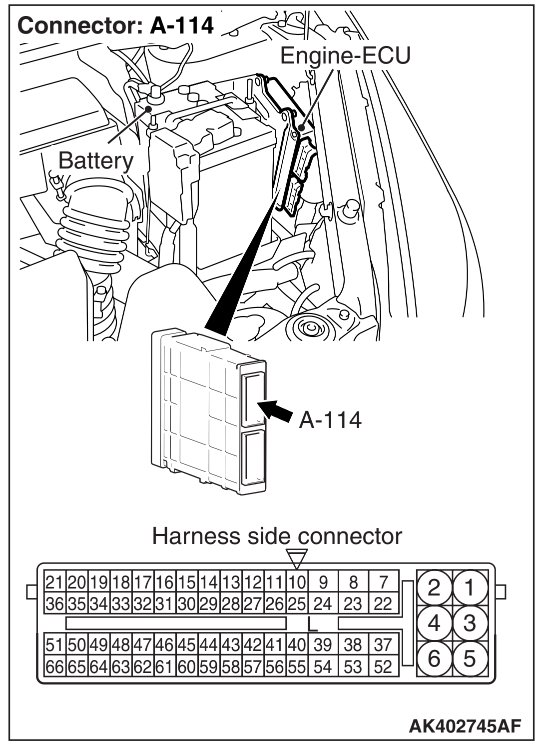
- Check output line for open/short circuit and damage.

Q: Is the check result normal?

YES : Go to Step 10 .

NO : Repair.

STEP 10. Perform signal wave pattern measurement at A-114 engine-ECU connector (Using an oscilloscope).



- Disconnect engine-ECU connector, and connect special tool power plant ECU check harness (MB991987) and measure the voltage on the check connector.
- Engine: Idling
- Transmission: Neutral
- Voltage between terminal No. 24 and earth.

OK: Waveform as shown in Inspection Procedure with Oscilloscope (Refer to P.13B-352) should be displayed.

Q: Is the check result normal?

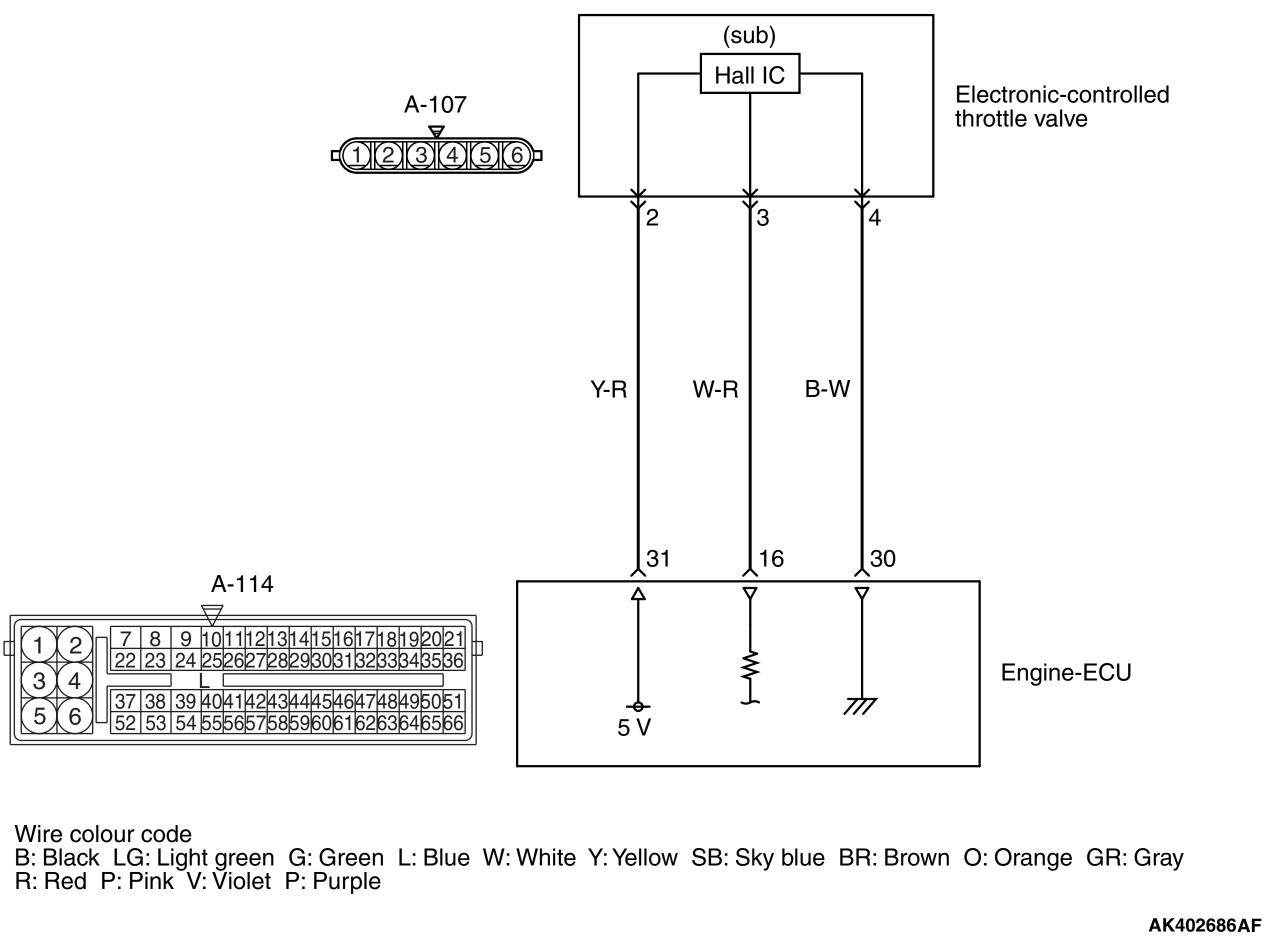
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

NO : Replace engine-ECU.

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Code No. P0222: Throttle Position Sensor (Sub) Circuit Low Input

Throttle Position Sensor (sub) Circuit



OPERATION

- A power voltage of 5 V is applied to the electronic-controlled throttle valve (terminal No. 2) from the engine-ECU (terminal No. 31).
- The power voltage is earthed to the engine-ECU (terminal No. 30) from the electronic-controlled throttle valve (terminal No. 4).
- The sensor signal is inputted to the engine-ECU (terminal No. 16) from the electronic-controlled throttle valve output terminal (terminal No. 3).

FUNCTION

- The throttle position sensor converts the throttle valve position into voltage and inputs it into the engine-ECU.
- The engine-ECU controls the throttle valve position.

TROUBLE JUDGMENT

Check Condition

- Ignition switch is in "ON" position.

Judgment Criterion

- Throttle position sensor (sub) output voltage is less than 0.2 V.

PROBABLE CAUSES

- Failed throttle position sensor (sub)
- Open/short circuit and damage in throttle position sensor (sub) circuit or loose connector contact
- Failed engine-ECU

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DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list

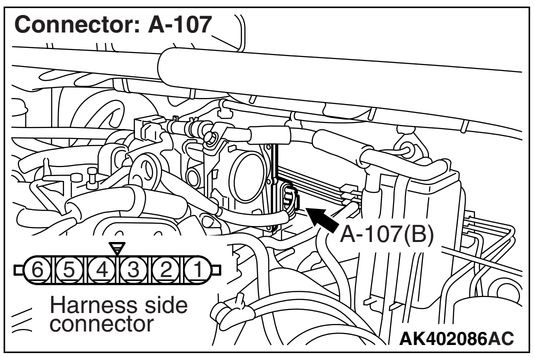
- Refer to Data List Reference Table P.13B-335.
  a. Item No. 14: Throttle position sensor (sub)

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

NO : Go to Step 2 .

STEP 2. Connector check: A-107 electronic-controlled throttle valve connector

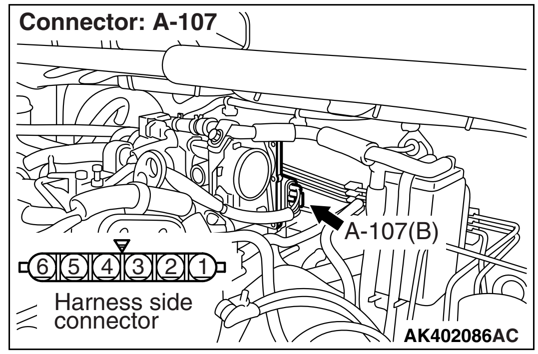


Q: Is the check result normal?

YES : Go to Step 3 .

NO : Repair or replace the connector.

STEP 3. Perform voltage measurement at A-107 electronic-controlled throttle valve connector.



- Disconnect connector, and measure at harness side.
- Ignition switch: ON
- Voltage between terminal No. 2 and earth.

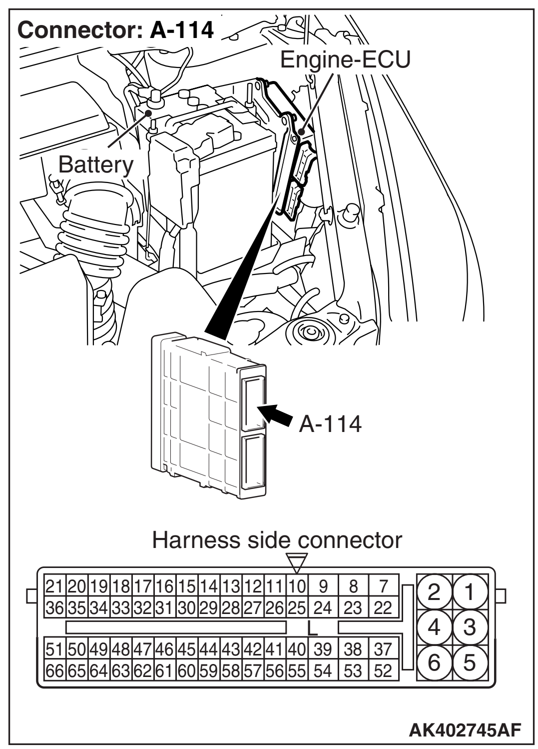
OK: 4.9 – 5.1 V

Q: Is the check result normal?

YES : Go to Step 7 .

NO : Go to Step 4 .

STEP 4. Connector check: A-114 engine-ECU connector



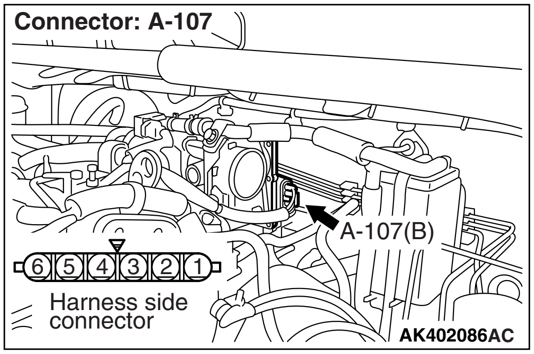
Q: Is the check result normal?

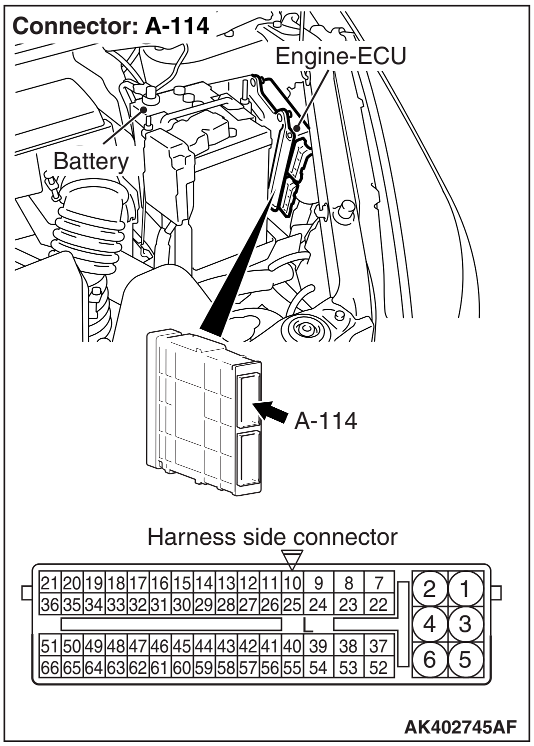
YES : Go to Step 5 .

NO : Repair or replace the connector.

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STEP 5. Check harness between A-107 (terminal No. 2) electronic-controlled throttle valve connector and A-114 (terminal No. 31) engine-ECU connector.





- Check power supply line for open/short circuit.

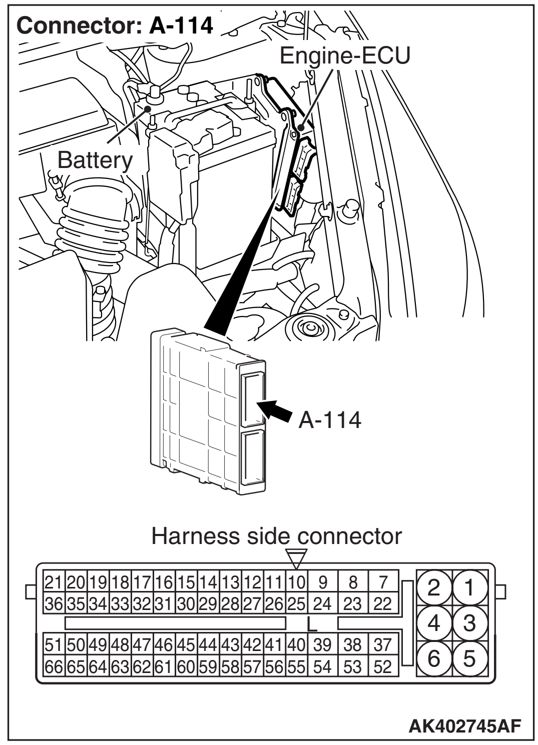
Q: Is the check result normal?
YES : Go to Step 6 .
NO : Repair the damaged harness wire.

STEP 6. M.U.T.-III data list

- Refer to Data List Reference Table P.13B-335.
  a. Item No. 14: Throttle position sensor (sub)

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).
NO : Replace engine-ECU.

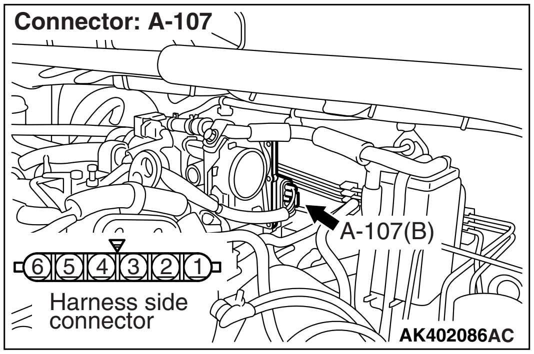
STEP 7. Connector check: A-114 engine-ECU connector

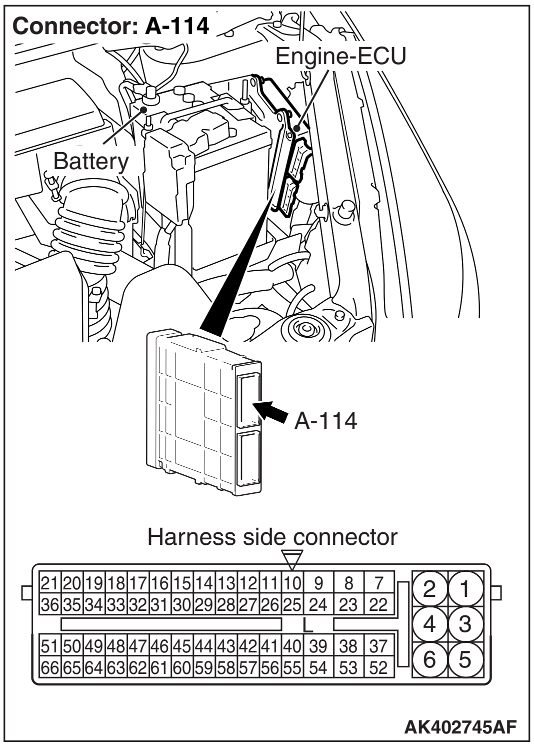


Q: Is the check result normal?
YES : Go to Step 8 .
NO : Repair or replace the connector.

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STEP 8. Check harness between A-107 (terminal No. 2) electronic-controlled throttle valve connector and A-114 (terminal No. 31) engine-ECU connector.





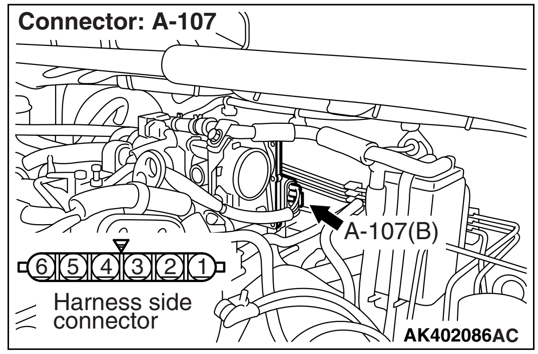
- Check power supply line for damage.

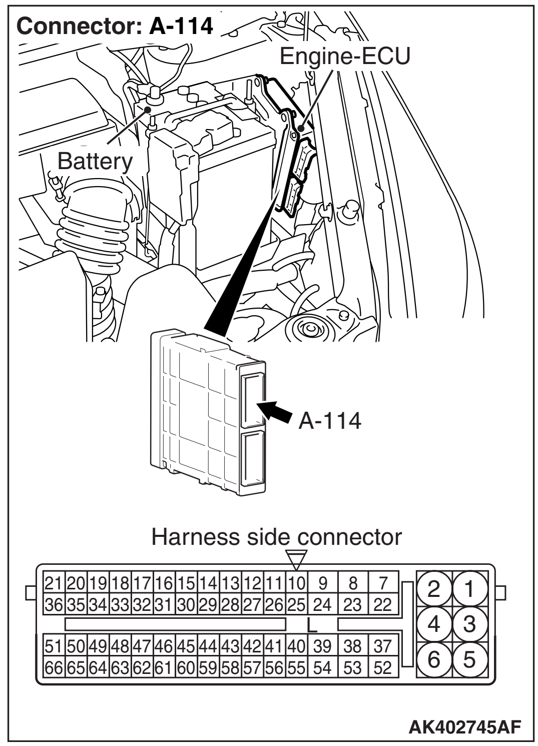
Q: Is the check result normal?

YES : Go to Step 9 .

NO : Repair the damaged harness wire.

STEP 9. Check harness between A-107 (terminal No. 3) electronic-controlled throttle valve connector and A-114 (terminal No. 16) engine-ECU connector.





- Check output line for open/short circuit and damage.

Q: Is the check result normal?

YES : Go to Step 10 .

NO : Repair the damaged harness wire.

STEP 10. Replace throttle body assembly

- After replacing the throttle body assembly, re-check the trouble symptoms.

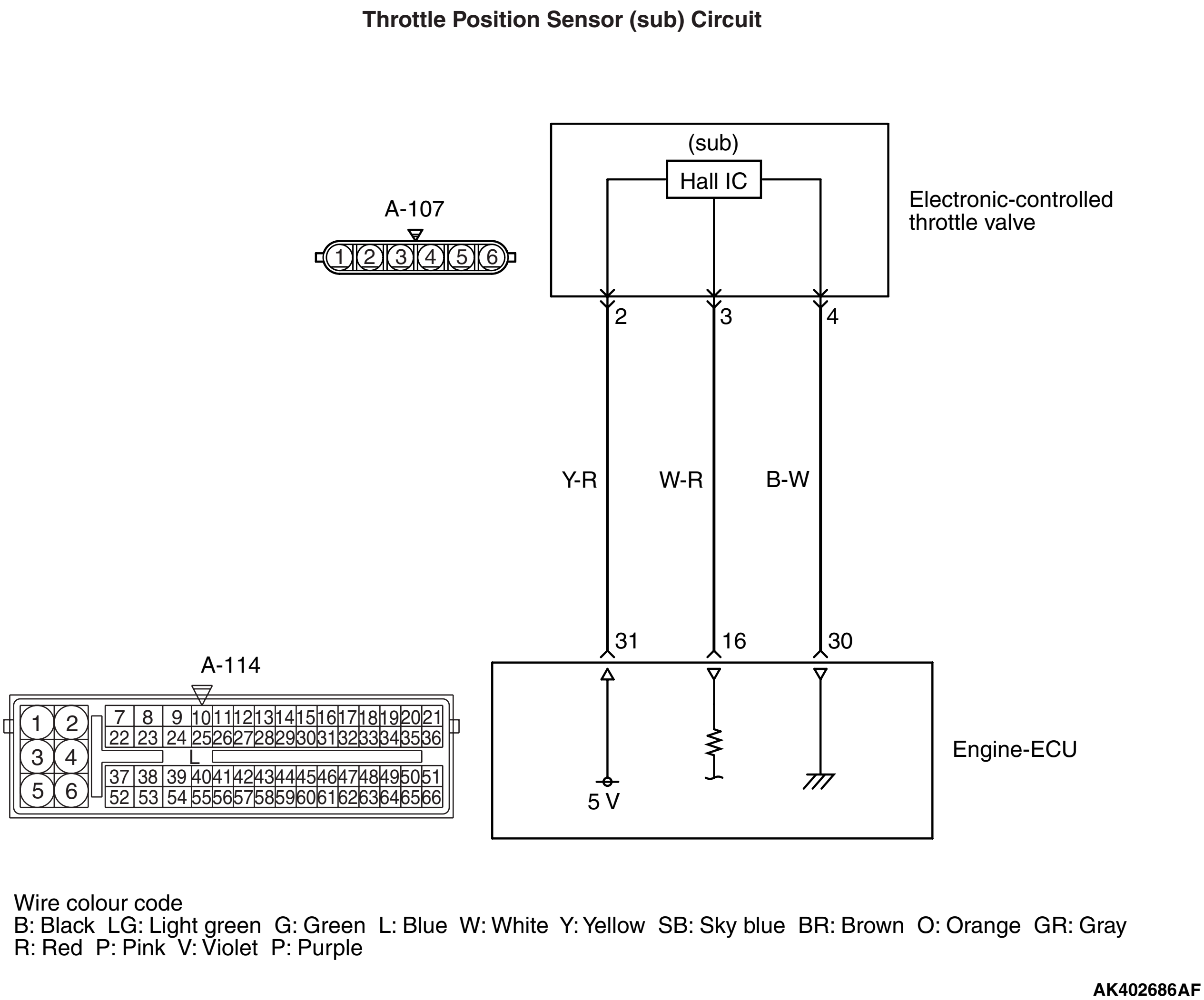
Q: Is the check result normal?

YES : Check end.

NO : Replace engine-ECU.

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Code No. P0223: Throttle Position Sensor (Sub) Circuit High Input



OPERATION

- A power voltage of 5 V is applied to the electronic-controlled throttle valve (terminal No. 2) from the engine-ECU (terminal No. 31).
- The power voltage is earthed to the engine-ECU (terminal No. 30) from the electronic-controlled throttle valve (terminal No. 4).
- The sensor signal is inputted to the engine-ECU (terminal No. 16) from the electronic-controlled throttle valve output terminal (terminal No. 3).

FUNCTION

- The throttle position sensor converts the throttle valve position into voltage and inputs it into the engine-ECU.
- The engine-ECU controls the throttle valve position.

TROUBLE JUDGMENT

Check Condition

- Ignition switch is in "ON" position.

Judgment Criterion

- Throttle position sensor (sub) output voltage is more than 4.8 V.

PROBABLE CAUSES

- Failed throttle position sensor (sub)
- Open/short circuit and damage in throttle position sensor (sub) circuit or loose connector contact
- Failed engine-ECU

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DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list

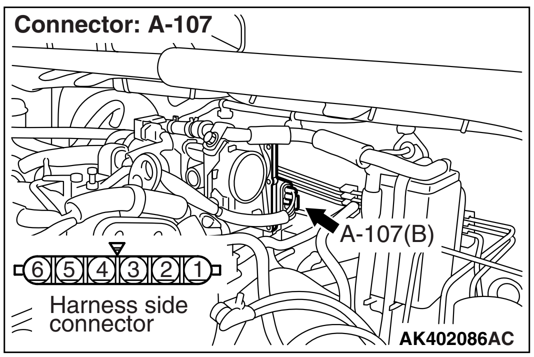
- Refer to Data List Reference Table P.13B-335.
  a. Item No. 14: Throttle position sensor (sub)

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

NO : Go to Step 2 .

STEP 2. Connector check: A-107 electronic-controlled throttle valve connector

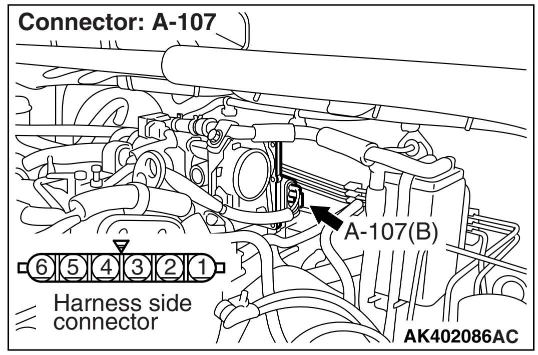


Q: Is the check result normal?

YES : Go to Step 3 .

NO : Repair or replace the connector.

STEP 3. Perform resistance measurement at A-107 electronic-controlled throttle valve connector.



- Disconnect connector, and measure at harness side.
- Resistance between terminal No. 4 and earth.

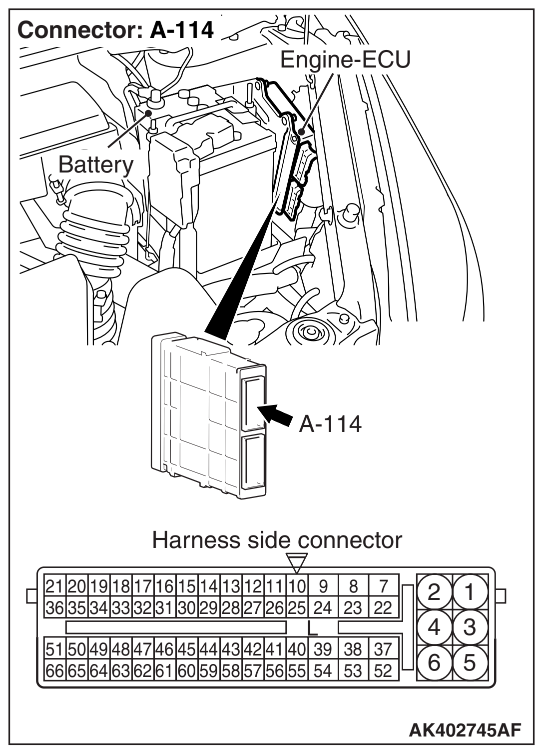
OK: Continuity (2 Ω or less)

Q: Is the check result normal?

YES : Go to Step 7 .

NO : Go to Step 4 .

STEP 4. Connector check: A-114 engine-ECU connector



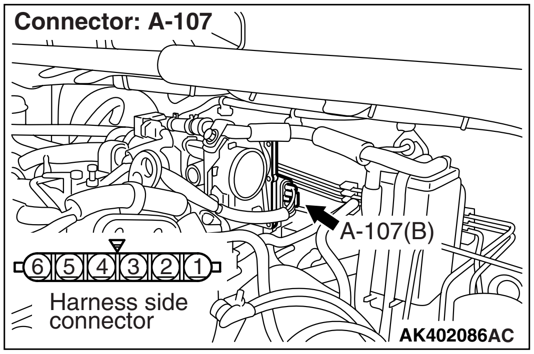
Q: Is the check result normal?

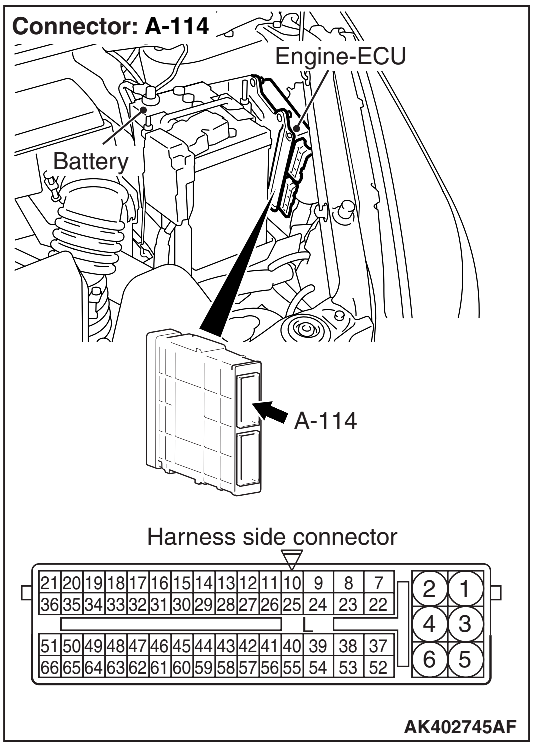
YES : Go to Step 5 .

NO : Repair or replace the connector.

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STEP 5. Check harness between A-107 (terminal No. 4) electronic-controlled throttle valve connector and A-114 (terminal No. 30) engine-ECU connector.





- Check earthing line for open circuit and damage.

Q: Is the check result normal?
YES : Go to Step 6 .
NO : Repair the damaged harness wire.

STEP 6. M.U.T.-III data list

- Refer the to Data List Reference Table P.13B-335.
  a. Item No. 14: Throttle position sensor (sub)

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).
NO : Replace engine-ECU.

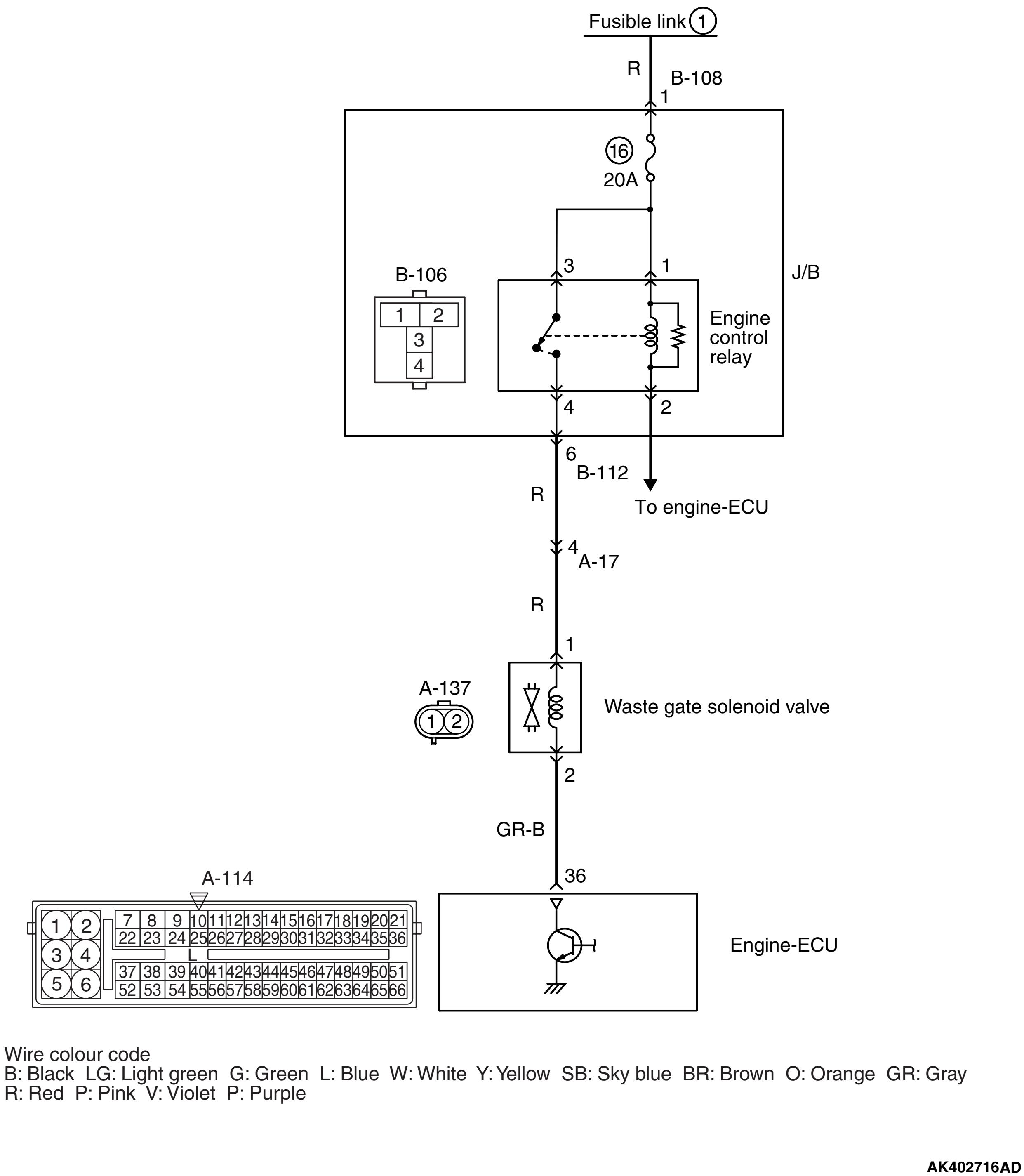
STEP 7. Replace the throttle body assembly

- After replacing the throttle body assembly, re-check the trouble symptoms.

Q: Is the check result normal?
YES : Check end.
NO : Replace engine-ECU.

Code No. P0243: Waste Gate Solenoid Valve System

Waste Gate Solenoid Valve Circuit



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OPERATION

- Power is supplied to the waste gate solenoid valve (terminal No. 1) from the engine control relay (terminal No. 4).
- The engine-ECU (terminal No. 36) makes the power transistor in the unit be in ON position, and that makes currents go to the waste gate solenoid valve (terminal No. 2).

FUNCTION

- In response to a signal from the engine-ECU, the waste gate solenoid valve controls the boost pressure to be introduced into the waste gate actuator of the turbocharger.

TROUBLE JUDGEMENT

Check Conditions

- While engine is running
- Battery voltage is more than 10 V and is less than 16 V.

Judgement Criterion

- Surge voltage cannot be detected when the waste gate solenoid valve has changed from ON to OFF.

PROBABLE CAUSES

- Failed waste gate solenoid valve
- Open/short circuit in waste gate solenoid valve circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III actuator test

- Item 12: Waste gate solenoid valve

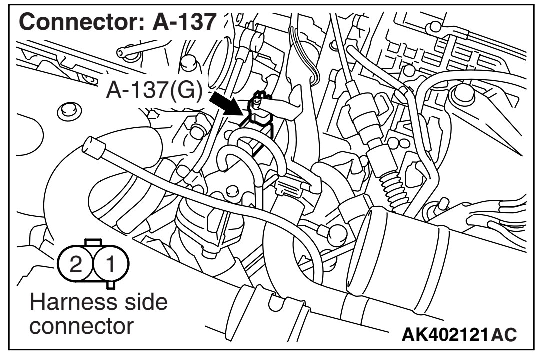
OK: Operating sound can be heard and the valve vibrates.

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

NO : Go to Step 2 .

STEP 2. Connector check: A-137 waste gate solenoid valve connector

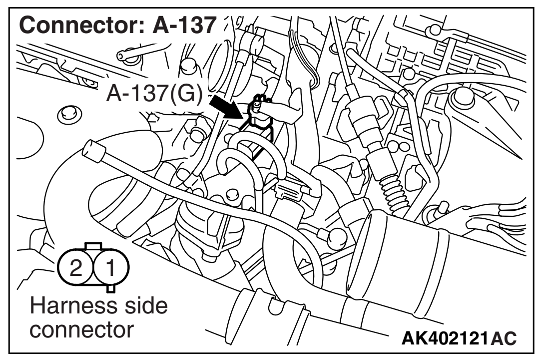


Q: Is the check result normal?

YES : Go to Step 3 .

NO : Repair or replace.

STEP 3. Perform resistance measurement at A-137 waste gate solenoid valve connector.



- Disconnect connector, and measure at solenoid valve side.
- Resistance between terminals No. 1 and No. 2.

OK: 29 – 35 Ω (at 20°C)

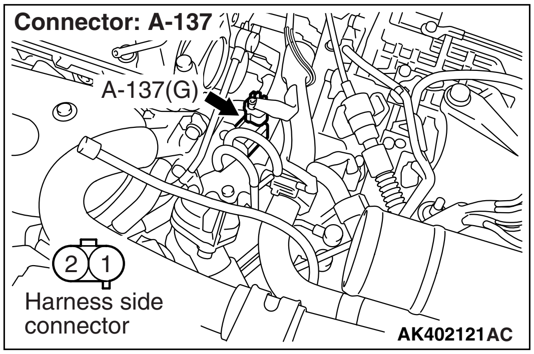
Q: Is the check result normal?

YES : Go to Step 4 .

NO : Replace waste gate solenoid valve.

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STEP 4. Perform voltage measurement at A-137 waste gate solenoid valve connector.



- Disconnect connector and measure at harness side.
- Ignition switch: ON
- Voltage between terminal No. 1 and earth.

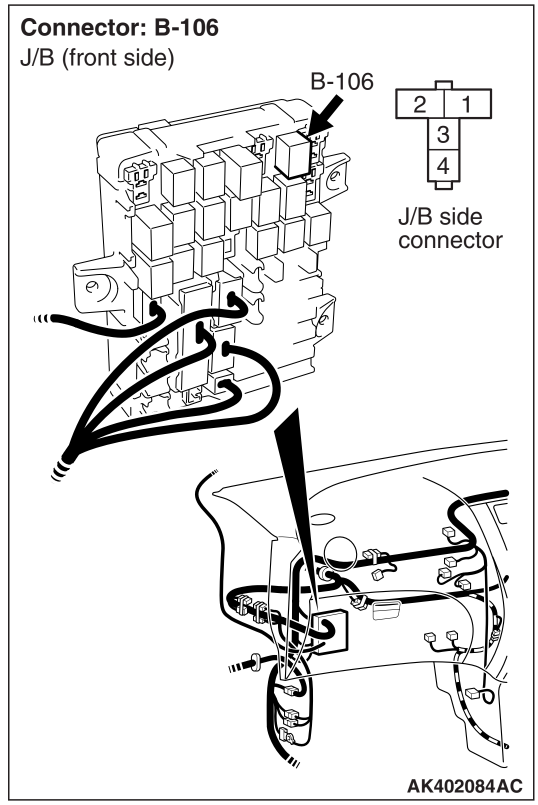
OK: System voltage

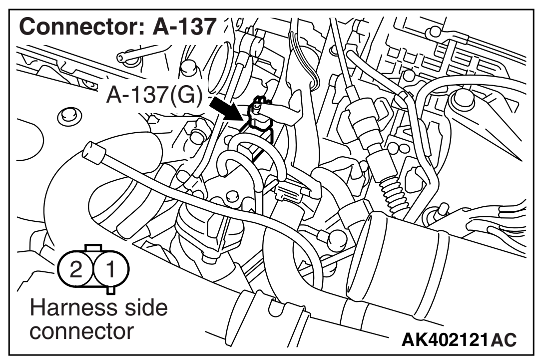
Q: Is the check result normal?

YES : Go to Step 6 .

NO : Go to Step 5 .

STEP 5. Connector check: B-106 engine control relay connector





Q: Is the check result normal?

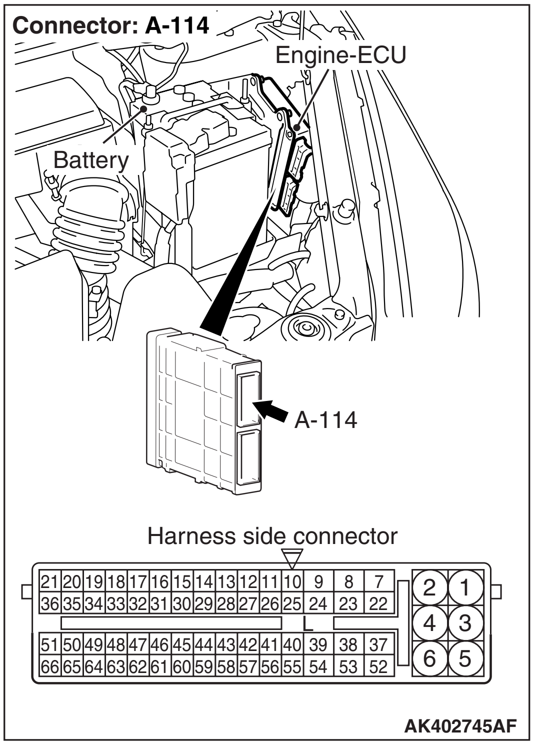
YES : Check intermediate connectors A-17 and B-112, and repair if necessary. If intermediate connectors are normal, check and repair harness between A-137 (terminal No. 1) waste gate solenoid valve connector and B-106 (terminal No. 4) engine control relay connector.

- Check power supply line for open/short circuit.

NO : Repair or replace.

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STEP 6. Perform voltage measurement at A-114 engine-ECU connector.

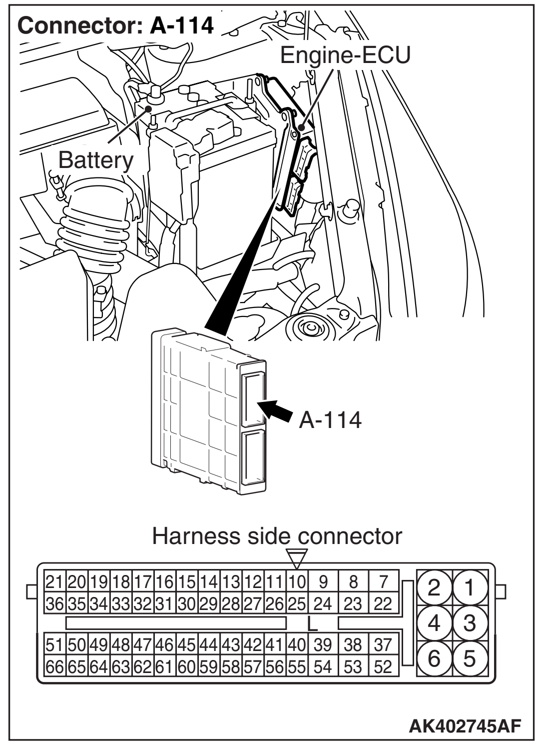


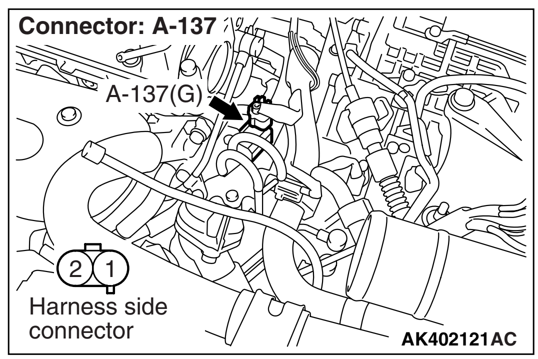
- Disconnect connector and measure at harness side.
- Ignition switch: ON
- Voltage between terminal No. 36 and earth.

  OK: System voltage

Q: Is the check result normal?
  YES : Go to Step 8 .
  NO : Go to Step 7 .

STEP 7. Connector check: A-114 engine-ECU connector



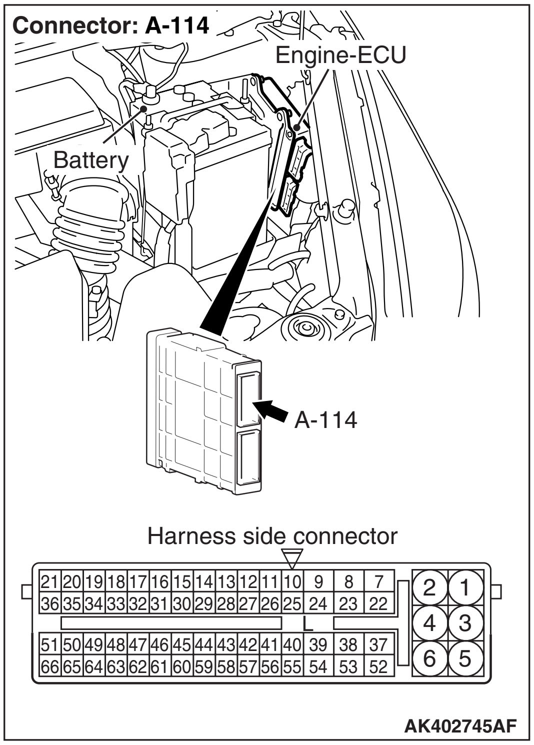


Q: Is the check result normal?
  YES : Check and repair harness between A-137 (terminal No. 2) waste gate solenoid valve connector and A-114 (terminal No. 36) engine-ECU connector.
  - Check output line for open/short circuit.

  NO : Repair or replace.

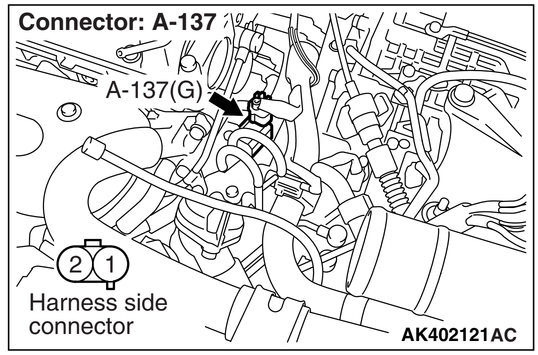
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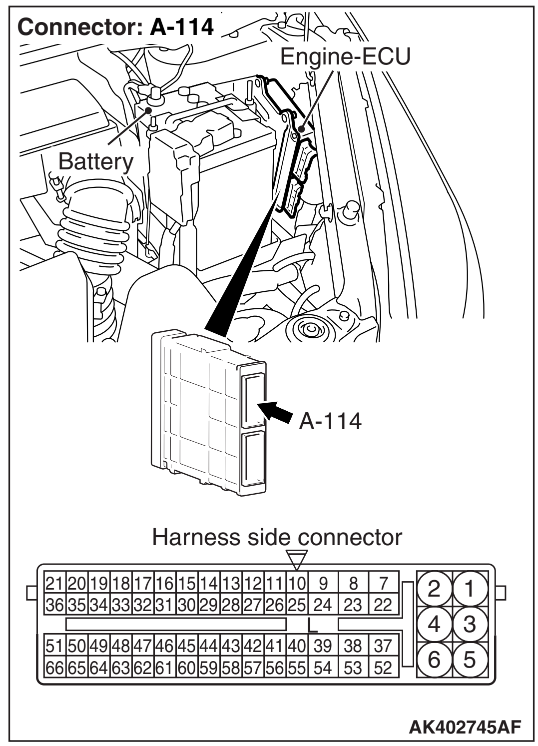
STEP 8. Connector check: A-114 engine-ECU connector



Q: Is the check result normal?
YES : Go to Step 9 .
NO : Repair or replace.

STEP 9. Check harness between A-137 (terminal No. 2) waste gate solenoid valve connector and A-114 (terminal No. 36) engine-ECU connector.



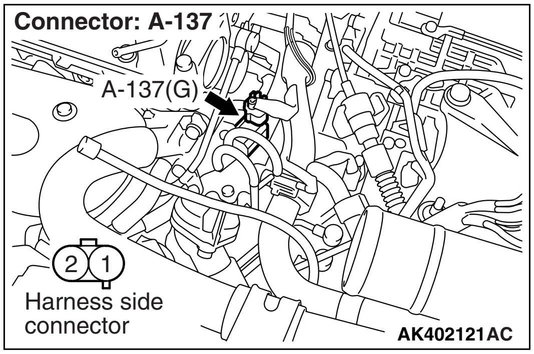


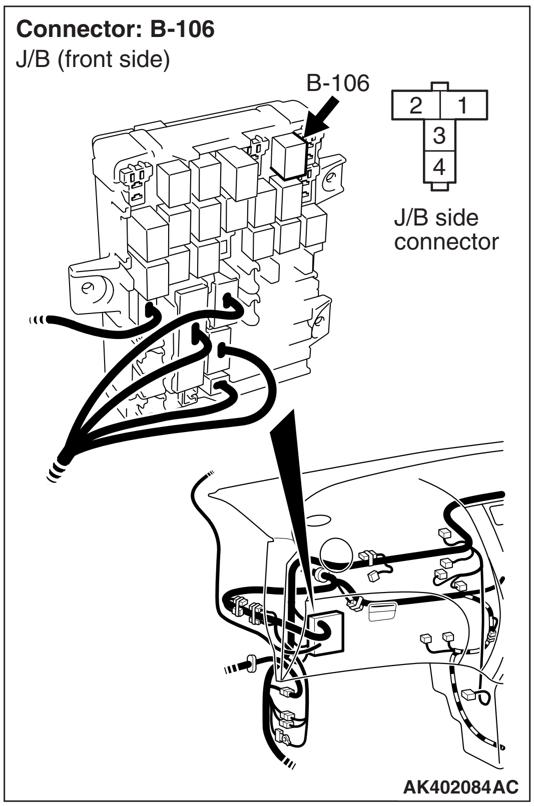
- Check output line for damage.

Q: Is the check result normal?
YES : Go to Step 10 .
NO : Repair.

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STEP 10. Check harness between A-137 (terminal No. 1) waste gate solenoid valve connector and B-106 (terminal No. 4) engine control relay connector.





NOTE: Before checking harness, check intermediate connectors A-17 and B-112, and repair if necessary.

- Check power supply line for damage.

Q: Is the check result normal?

YES : Go to Step 11 .
NO : Repair.

STEP 11. M.U.T.-III actuator test

- Item 12: Waste gate solenoid valve

OK: Operating sound can be heard and the valve vibrates.

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).
NO : Replace engine-ECU.

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Code No. P0300: Random/Multiple Cylinder Misfire Detected

OPERATION

- Refer to Code No. P0201: No. 1 injector system P.13B-92.
- Refer to Code No. P0202: No. 2 injector system P.13B-97.
- Refer to Code No. P0203: No. 3 injector system P.13B-102.
- Refer to Code No. P0204: No. 4 injector system P.13B-107.

FUNCTION

- If a misfire occurs while the engine is running, the engine speed changes for an instant.
- The engine-ECU checks for such changes in engine speed.

TROUBLE JUDGMENT

Check Conditions

- Engine speed is more than 500 r/min and is less than 4,500 r/min.
- Engine coolant temperature is more than -10°C.
- Volume efficiency is more than 35%
- Adaptive learning is completed for the vane which generates a crankshaft position signal.
- While the engine is running, excluding gear shifting, deceleration, sudden acceleration/deceleration and switching A/C compressor.
- When the variation in the throttle valve opening angle is small.

Judgement Criterion

- Misfire occurred more frequently than the limit during the last 200 revolutions

Or

- Misfire occurred more than the limit during the last 1,000 revolutions

PROBABLE CAUSES

- Ignition system related part(s) failed
- Failed crank angle sensor
- Incorrect air-fuel ratio
- Low compression pressure
- Failed fuel system
- Failed engine coolant temperature sensor
- Skipping of timing belt teeth.
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1.M.U.T.-III data list

- Item No. 22: Crank angle sensor

OK: Keep the engine speed constant to make the pulse width of output waveform constant.

Q: Is the check result normal?

YES : Go to Step 2 .

NO : Check crank angle sensor system (Refer to Code No. P0335 P.13B-142).

STEP 2. M.U.T.-III data list

- Refer to Data List Reference Table P.13B-335.

a. Item No. 21: Engine coolant temperature sensor
b. Item No. 81: Long-term fuel compensation
c. Item No. 82: Short-term fuel compensation

Q: Are the check results normal?

YES : Go to Step 3 .

NO : Perform the diagnosis code classified check procedure for the sensor that has shown an abnormal data valve (Refer to Inspection Chart for Diagnosis Code P.13B-18).

STEP 3. Check ignition coil spark.

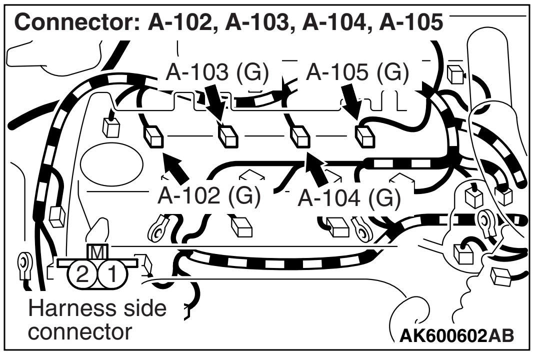
Q: Is the check result normal?

YES : Go to Step 4 .

NO : Check ignition circuit system (Refer to Inspection Procedure 24 P.13B-327).

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STEP 4. Connector check: Injector connectors



a. A-102 (No. 1 injector connector)
b. A-103 (No. 2 injector connector)
c. A-104 (No. 3 injector connector)
d. A-105 (No. 4 injector connector)

Q: Are the check results normal?
YES : Go to Step 5 .
NO : Repair or replace the connector.

STEP 5. Check injector itself.

- Check Injector itself (Refer to P.13B-367).

Q: Is the check result normal?
YES : Go to Step 6 .
NO : Replace the injector.

STEP 6. Fuel pressure measurement.

- Fuel pressure measurement (Refer to Fuel Pressure Test P.13B-358).

Q: Is the check result normal?
YES : Go to Step 7 .
NO : Repair the fuel pressure.

STEP 7. Check for intake of air from gaps in gasket, seals, etc.

Q: Is the check result normal?
YES : Go to Step 8 .
NO : Repair for intake of air from gaps in gasket, seals, etc.

STEP 8. Check for skipped timing belt teeth.

Q: Is the check result normal?
YES : Go to Step 9 .
NO : Repair for skipped timing chain teeth.

STEP 9. M.U.T.-III diagnosis code.

- Reconfirmation of diagnosis code.

Q: Is the diagnosis code set?
YES : Replace engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

Code No. P0301: No. 1 Cylinder Misfire Detected

OPERATION

- Refer to Code No. P0201: No. 1 Injector System P.13B-92.

FUNCTION

- If a misfire occurs while the engine is running, the engine speed changes for an instant.
- The engine-ECU checks for such changes in engine speed.

TROUBLE JUDGMENT

Check Conditions

- Engine speed is more than 500 r/min and is less than 4,500 r/min.
- Engine coolant temperature is more than -10°C.
- Volume efficiency is more than 35%
- Adaptive learning is completed for the vane which generates a crankshaft position signal.
- While the engine is running, excluding gear shifting, deceleration, sudden acceleration/deceleration and switching A/C compressor.
- When the variation in the throttle valve opening angle is small.

Judgement Criterion

- Misfire occurred more frequently than the limit during the last 200 revolutions

Or

- Misfire occurred more than the limit during the last 1,000 revolutions

PROBABLE CAUSES

- Ignition system related part(s) failed
- Low compression pressure
- Failed fuel system
- Failed engine-ECU

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DIAGNOSIS PROCEDURE

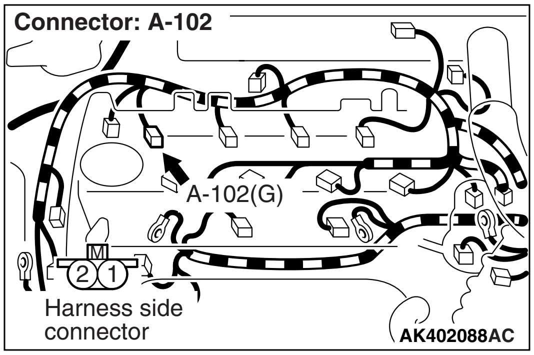
STEP 1. Check ignition coil spark.

Q: Is the check result normal?

YES : Go to Step 2 .

NO : Check ignition circuit system (Refer to Inspection procedure 26 P.13B-327).

STEP 2. Connector check: A-102 No. 1 injector connector



Q: Is the check result normal?

YES : Go to Step 3 .

NO : Repair or replace the connector.

STEP 3. Check No. 1 injector itself.

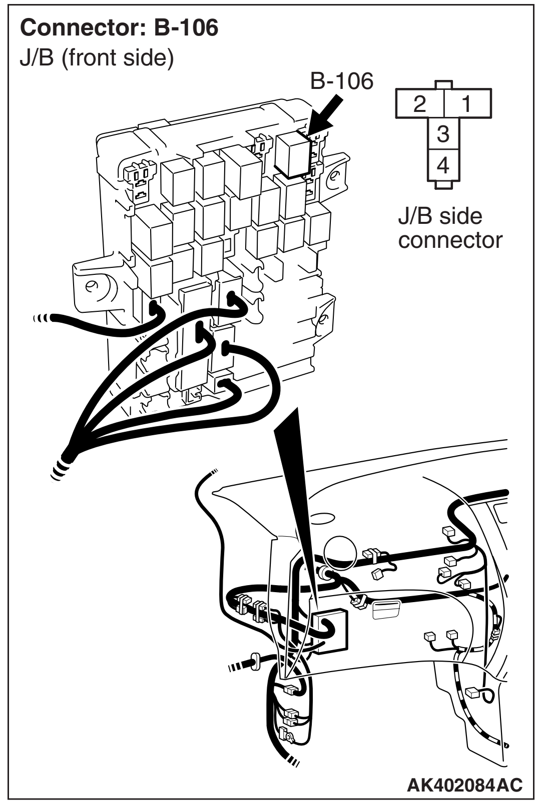
- Check Injector itself (Refer to P.13B-367).

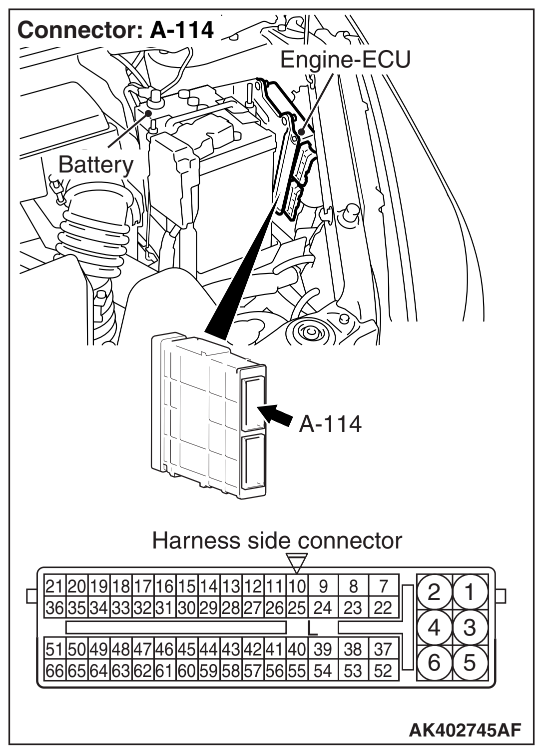
Q: Is the check result normal?

YES : Go to Step 4 .

NO : Replace the No. 1 injector.

STEP 4. Connector check: B-106 engine control relay connector and A-114 engine-ECU connector





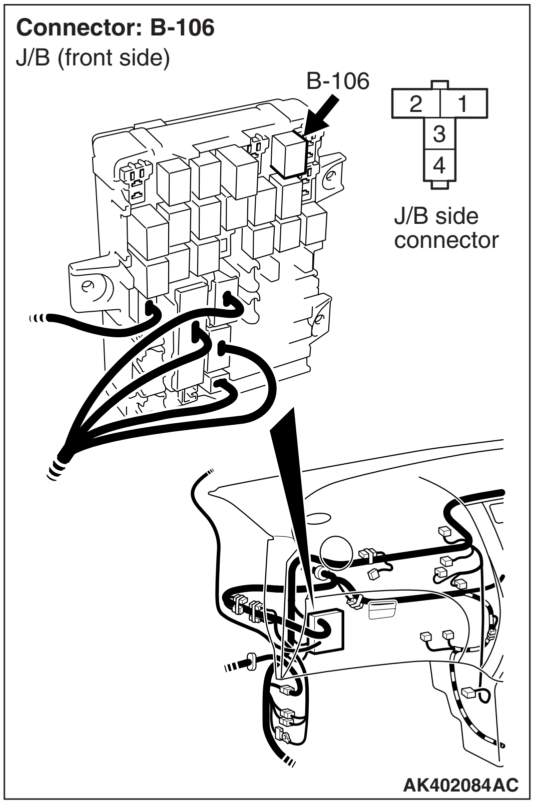
Q: Is the check result normal?

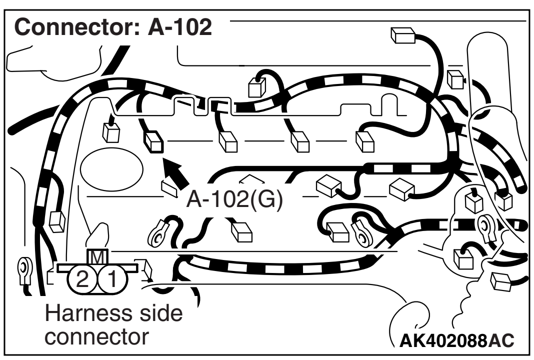
YES : Go to Step 5 .

NO : Repair or replace the connector.

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STEP 5. Check harness between B-106 (terminal No. 4) engine control relay connector and A-102 (terminal No. 1) No. 1 injector connector.





NOTE: Before checking harness, check intermediate connector A-17 and B-112, and repair if necessary.

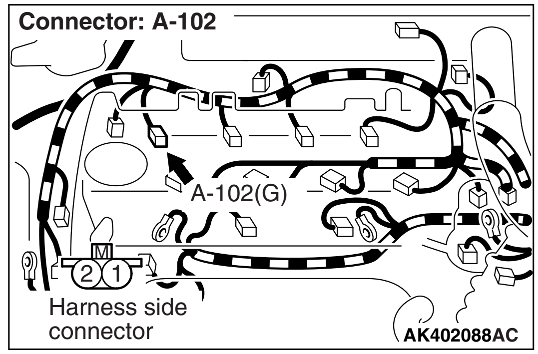
- Check power supply line for damage.

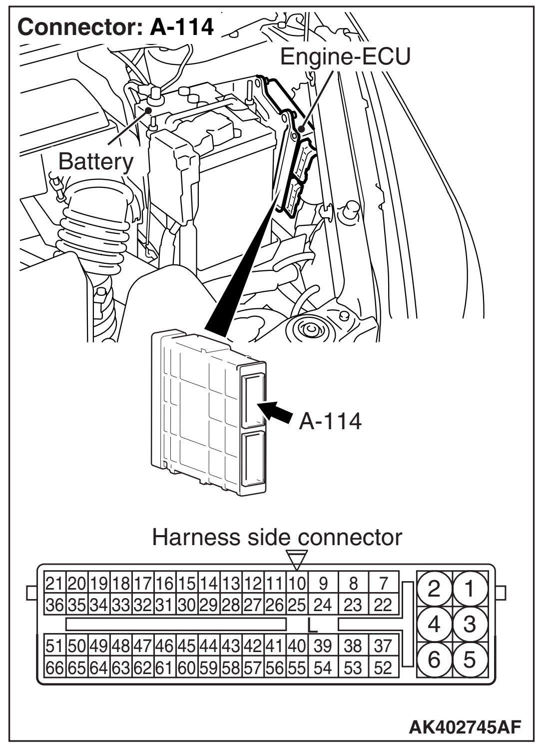
Q: Is the check result normal?

YES : Go to Step 6 .

NO : Repair the damaged harness wire.

STEP 6. Check harness between A-102 (terminal No. 2) No. 1 injector connector and A-114 (terminal No. 8) engine-ECU connector





- Check earthing line for damage.

Q: Is the check result normal?

YES : Go to Step 7 .

NO : Repair the damaged harness wire.

STEP 7. Fuel pressure measurement.

- Fuel pressure measurement (Refer to Fuel Pressure Test P.13B-358).

Q: Is the check result normal?

YES : Go to Step 8

NO : Repair the fuel pressure.

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STEP 8. M.U.T.-III diagnosis code.

- Reconfirmation of diagnosis code.

Q: Is the diagnosis code set?

YES : Replace engine-ECU.

NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

Code No. P0302: No. 2 Cylinder Misfire Detected

OPERATION

- Refer to Code No. P0202 No. 2 Injector System P.13B-97.

FUNCTION

- If a misfire occurs while the engine is running, the engine speed changes for an instant.
- The engine-ECU checks for such changes in engine speed.

TROUBLE JUDGMENT

Check Conditions

- Engine speed is more than 500 r/min and is less than 4,500 r/min.
- Engine coolant temperature is more than -10°C.
- Volume efficiency is more than 35%
- Adaptive learning is completed for the vane which generates a crankshaft position signal.
- While the engine is running, excluding gear shifting, deceleration, sudden acceleration/deceleration and switching A/C compressor.
- When the variation in the throttle valve opening angle is small.

Judgement Criterion

- Misfire occurred more frequently than the limit during the last 200 revolutions

Or

- Misfire occurred more than the limit during the last 1,000 revolutions

PROBABLE CAUSES

- Ignition system related part(s) failed
- Low compression pressure
- Failed fuel system
- Failed engine-ECU

DIAGNOSIS PROCEDURE

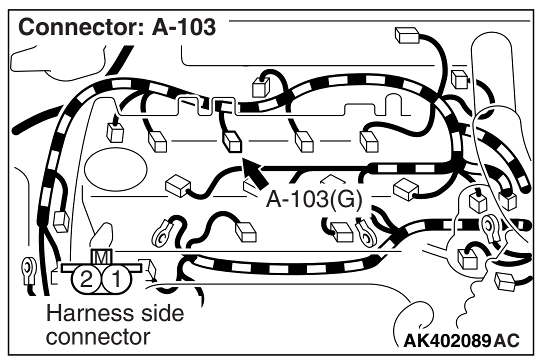
STEP 1. Check ignition coil spark.

Q: Is the check result normal?

YES : Go to Step 2 .

NO : Check ignition circuit system (Refer to Inspection Procedure 26 P.13B-327).

STEP 2. Check connector: A-103 No. 2 injector connector



Q: Is the check result normal?

YES : Go to Step 3 .

NO : Repair or replace the connector.

STEP 3. Check No. 2 injector itself.

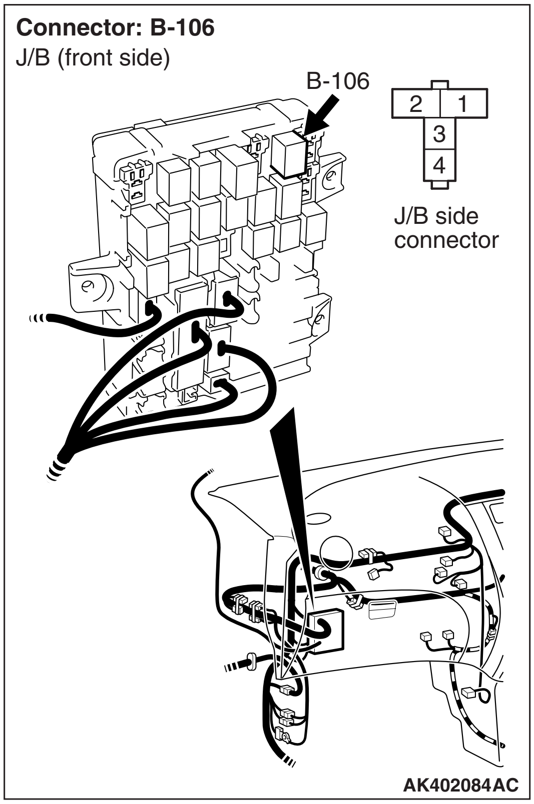
- Check Injector itself (Refer to P.13B-367).

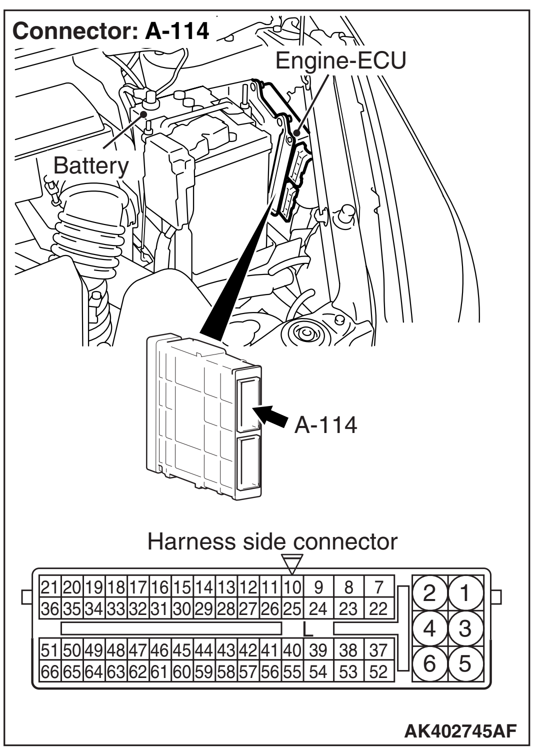
Q: Is the check result normal?

YES : Go to Step 4 .

NO : Replace the No. 2 injector.

STEP 4. Connector check: B-106 engine control relay connector and A-114 engine-ECU connector



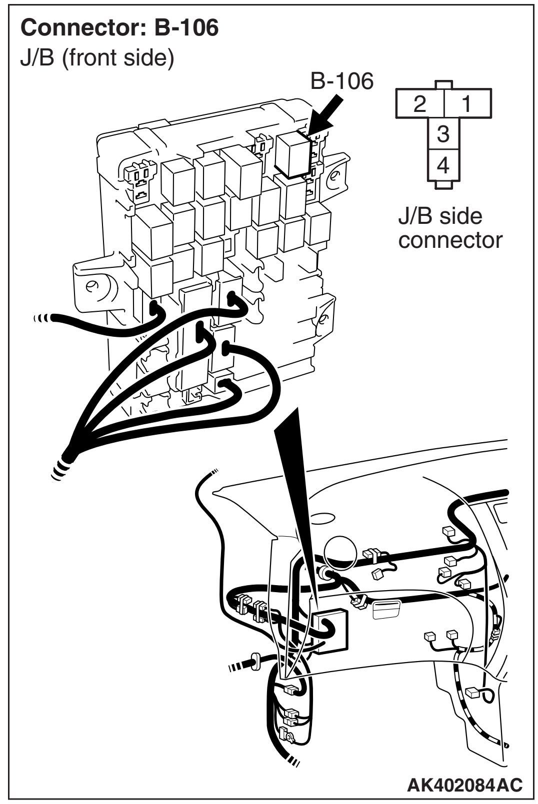


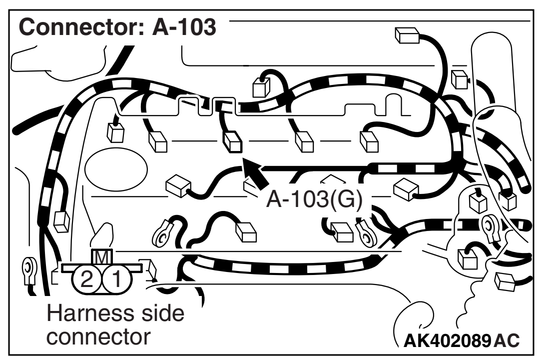
Q: Is the check result normal?

YES : Go to Step 5 .

NO : Repair or replace the connector.

STEP 5. Check harness between B-106 (terminal No. 4) engine control relay connector and A-103 (terminal No. 1) No. 2 injector connector.





NOTE: Before checking harness, check intermediate connector A-17 and B-112, and repair if necessary.

- Check power supply line for damage.

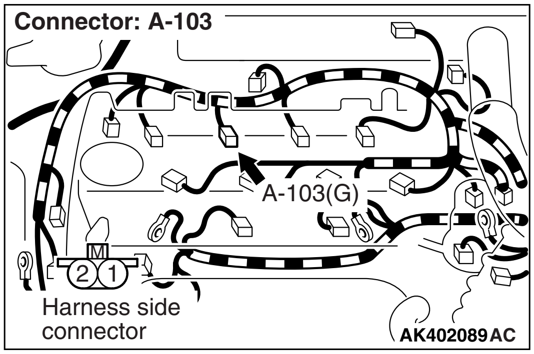
Q: Is the check result normal?

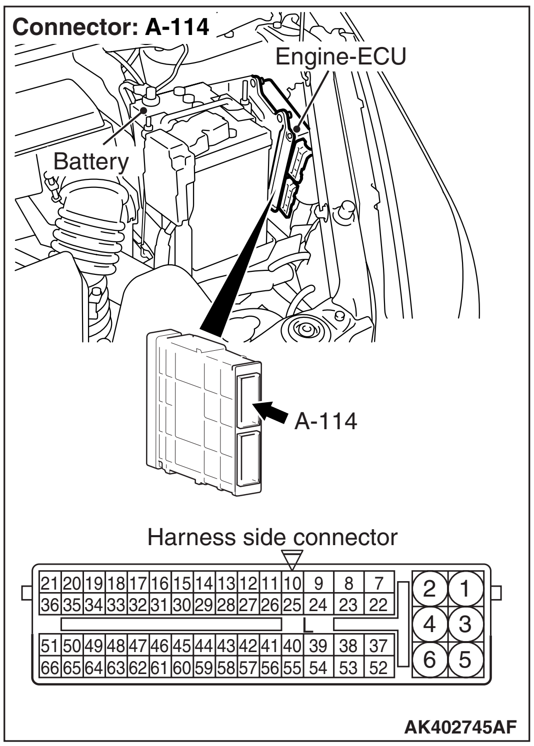
YES : Go to Step 6 .

NO : Repair the damaged harness wire.

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STEP 6. Check harness between A-103 (terminal No. 2) No. 2 injector connector and A-114 (terminal No. 9) engine-ECU connector





- Check earthing line for damage.

Q: Is the check result normal?

YES : Go to Step 7 .

NO : Repair the damaged harness wire.

STEP 7. Fuel pressure measurement.

- Fuel pressure measurement (Refer to Fuel Pressure Test P.13B-358).

Q: Is the check result normal?

YES : Go to Step 8 .

NO : Repair the fuel pressure.

STEP 8. M.U.T.-III diagnosis code.

- Reconfirmation of diagnosis code.

Q: Is the diagnosis code set?

YES : Replace engine-ECU.

NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

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Code No. P0303: No. 3 Cylinder Misfire Detected

OPERATION

- Refer to Code No. P0203 No. 3 Injector System P.13B-102.

FUNCTION

- If a misfire occurs while the engine is running, the engine speed changes for an instant.
- The engine-ECU checks for such changes in engine speed.

TROUBLE JUDGMENT

Check Conditions

- Engine speed is more than 500 r/min and is less than 4,500 r/min.
- Engine coolant temperature is more than -10°C.
- Volume efficiency is more than 35%
- Adaptive learning is completed for the vane which generates a crankshaft position signal.
- While the engine is running, excluding gear shifting, deceleration, sudden acceleration/deceleration and switching A/C compressor.
- When the variation in the throttle valve opening angle is small.

Judgement Criterion

- Misfire occurred more frequently than the limit during the last 200 revolutions

Or

- Misfire occurred more than the limit during the last 1,000 revolutions

PROBABLE CAUSES

- Ignition system related part(s) failed
- Low compression pressure
- Failed fuel system
- Failed engine-ECU

DIAGNOSIS PROCEDURE

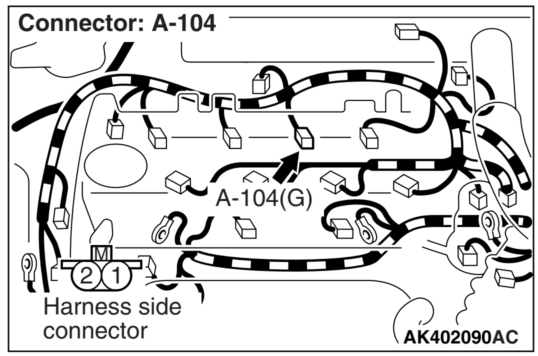
STEP 1. Check ignition coil spark.

Q: Is the check result normal?

YES : Go to Step 2 .

NO : Check ignition circuit system (Refer to Inspection Procedure 26 P.13B-327).

STEP 2. Connector check: A-104 No. 3 injector connector



Q: Is the check result normal?

YES : Go to Step 3 .

NO : Repair or replace the connector.

STEP 3. Check No. 3 injector itself.

- Check Injector itself (Refer to P.13B-367).

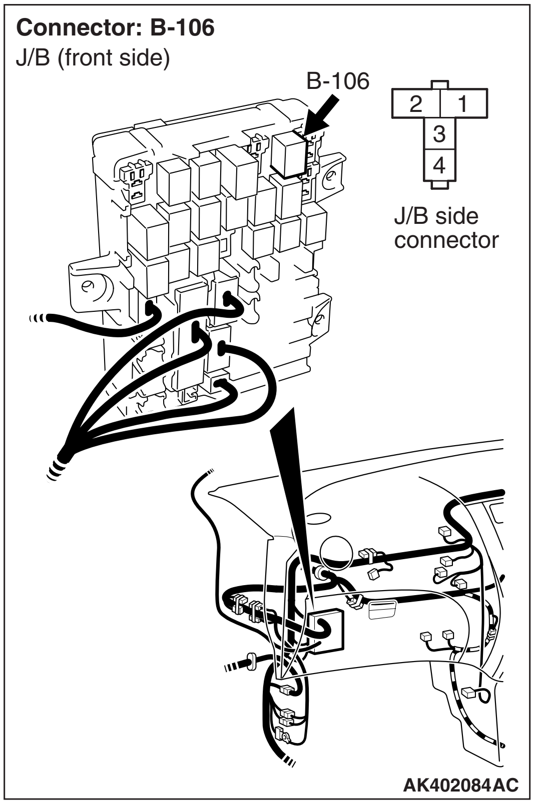
Q: Is the check result normal?

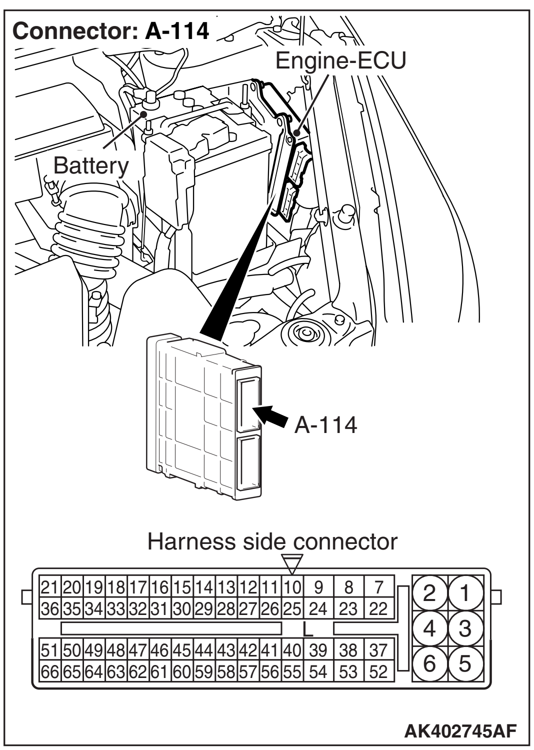
YES : Go to Step 4 .

NO : Replace the No. 3 injector.

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STEP 4. Connector check: B-106 engine control relay connector and A-114 engine-ECU connector



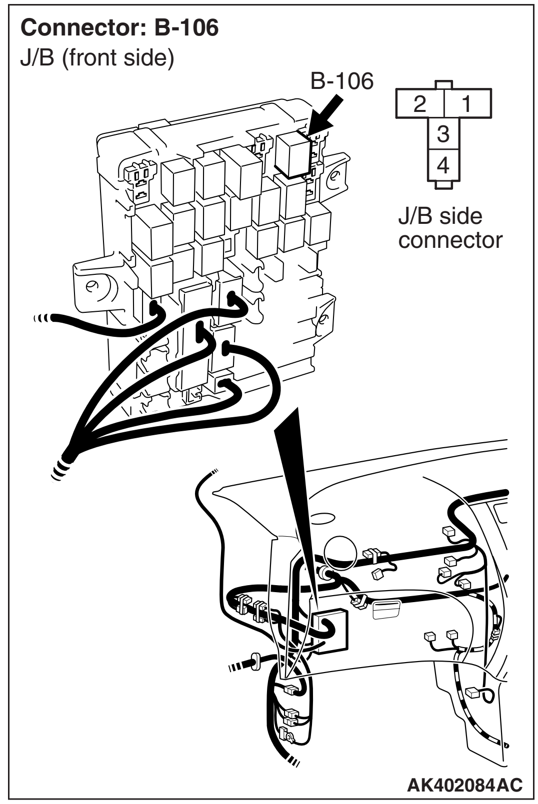


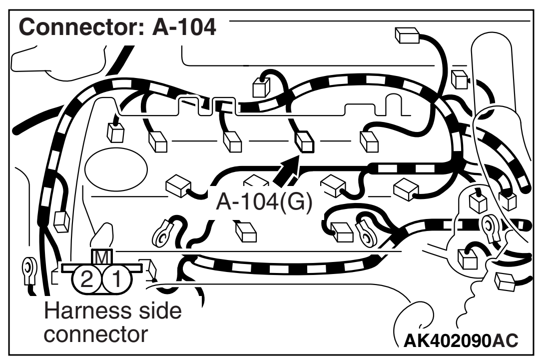
Q: Is the check result normal?

YES : Go to Step 5 .

NO : Repair or replace the connector.

STEP 5. Check harness between B-106 (terminal No. 4) engine control relay connector and A-104 (terminal No. 1) No. 3 injector connector.





NOTE: Before checking harness, check intermediate connector A-17 and B-112, and repair if necessary.

- Check power supply line for damage.

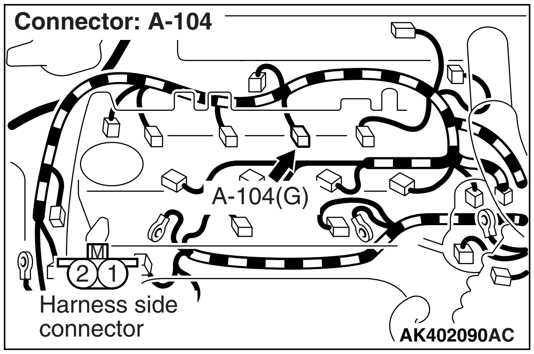
Q: Is the check result normal?

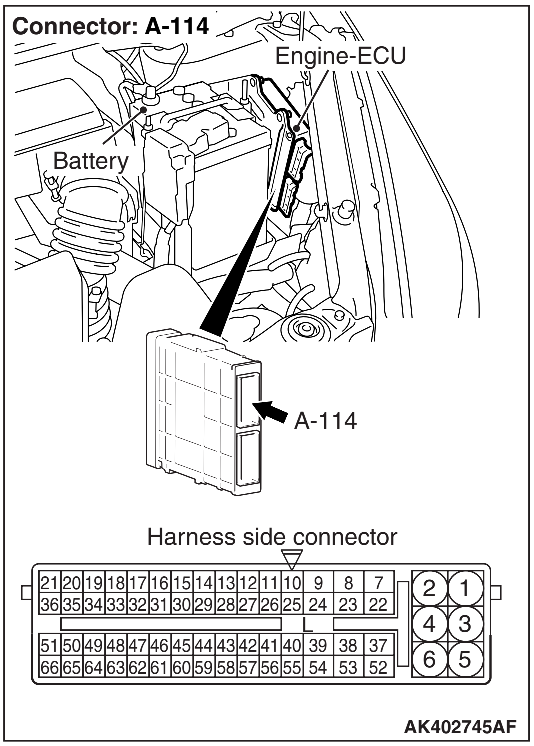
YES : Go to Step 6 .

NO : Repair the damaged harness wire.

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STEP 6. Check harness between A-104 (terminal No. 2) No. 3 injector connector and A-114 (terminal No. 23) engine-ECU connector





- Check earthing line for damage.

Q: Is the check result normal?
YES : Go to Step 7 .
NO : Repair the damaged harness wire.

STEP 7. Fuel pressure measurement.

- Fuel pressure measurement (Refer to Fuel Pressure Test P.13B-358).

Q: Is the check result normal?
YES : Go to Step 8 .
NO : Repair the fuel pressure.

STEP 8. M.U.T.-III diagnosis code.

- Reconfirmation of diagnosis code.

Q: Is the diagnosis code set?
YES : Replace engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

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Code No. P0304: No. 4 Cylinder Misfire Detected

OPERATION

- Refer to Code No. P0204 No. 4 Injector System P.13B-107.

FUNCTION

- If a misfire occurs while the engine is running, the engine speed changes for an instant.
- The engine-ECU checks for such changes in engine speed.

TROUBLE JUDGMENT

Check Conditions

- Engine speed is more than 500 r/min and is less than 4,500 r/min.
- Engine coolant temperature is more than -10°C.
- Volume efficiency is more than 35%
- Adaptive learning is completed for the vane which generates a crankshaft position signal.
- While the engine is running, excluding gear shifting, deceleration, sudden acceleration/deceleration and switching A/C compressor.
- When the variation in the throttle valve opening angle is small.

Judgement Criterion

- Misfire occurred more frequently than the limit during the last 200 revolutions

Or

- Misfire occurred more than the limit during the last 1,000 revolutions

PROBABLE CAUSES

- Ignition system related part(s) failed
- Low compression pressure
- Failed fuel system
- Failed engine-ECU

DIAGNOSIS PROCEDURE

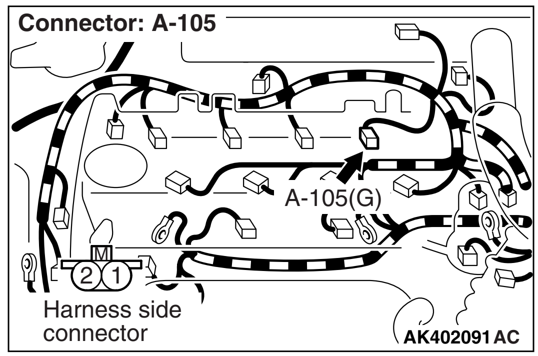
STEP 1. Check the ignition coil spark.

Q: Is the check result normal?

YES : Go to Step 2 .

NO : Check ignition Circuit System (Refer to Inspection Procedure 26 P.13B-327).

STEP 2. Connector check: A-105 No. 4 injector connector



Q: Is the check result normal?

YES : Go to Step 3 .

NO : Repair or replace the connector.

STEP 3. Check No. 4 injector itself.

- Check Injector itself (Refer to P.13B-367).

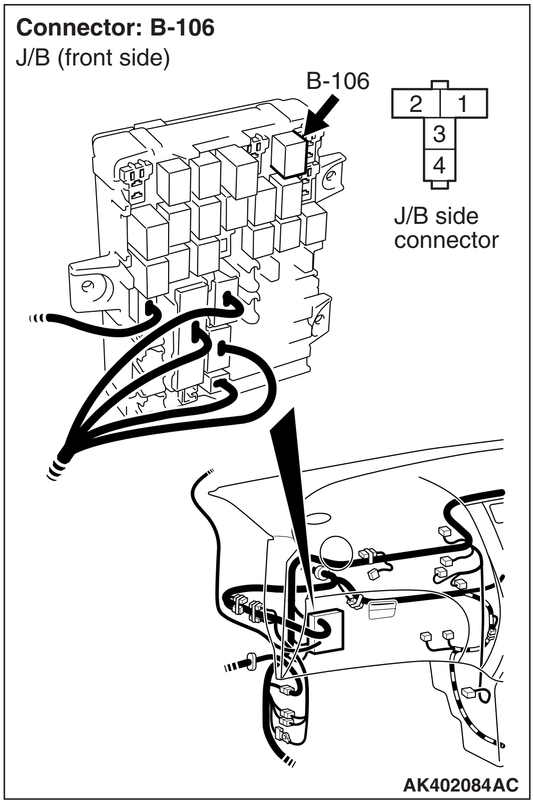
Q: Is the check result normal?

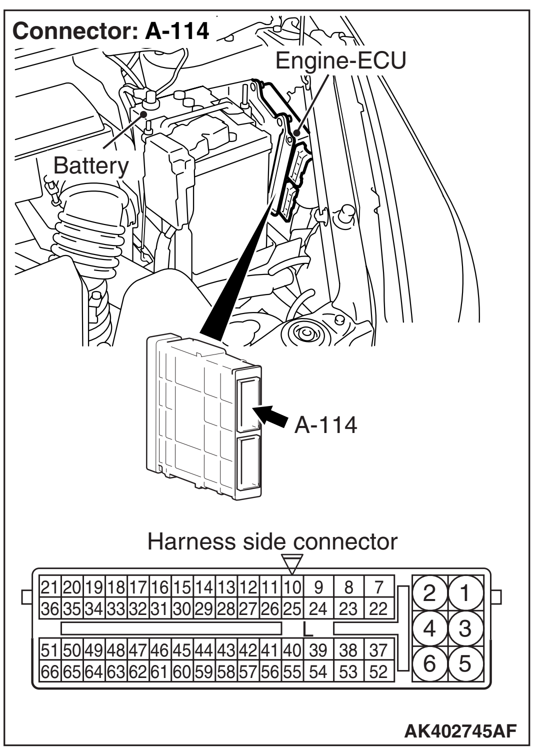
YES : Go to Step 4 .

NO : Replace the No. 4 injector.

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STEP 4. Connector check: B-106 engine control relay connector and A-114 engine-ECU connector



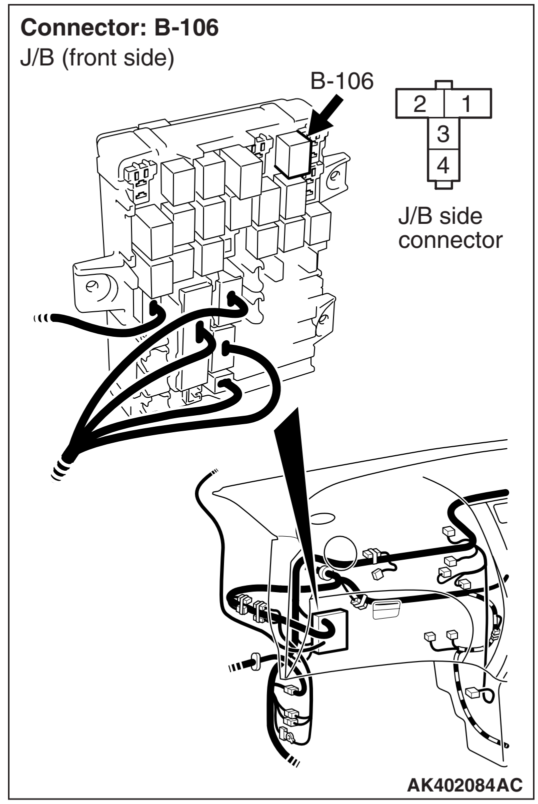


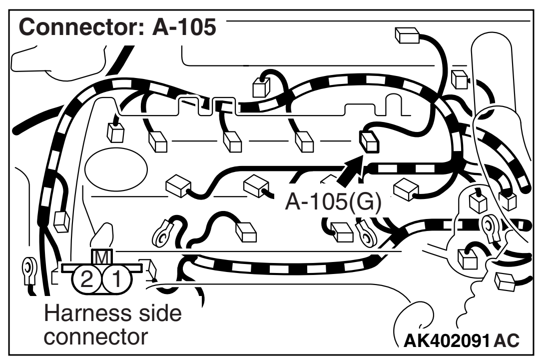
Q: Is the check result normal?

YES : Go to Step 5 .

NO : Repair or replace the connector.

STEP 5. Check harness between B-106 (terminal No. 4) engine control relay connector and A-105 (terminal No. 1) No. 4 injector connector.





NOTE: Before checking harness, check intermediate connector A-17 and B-112, and repair if necessary.

- Check power supply line for damage.

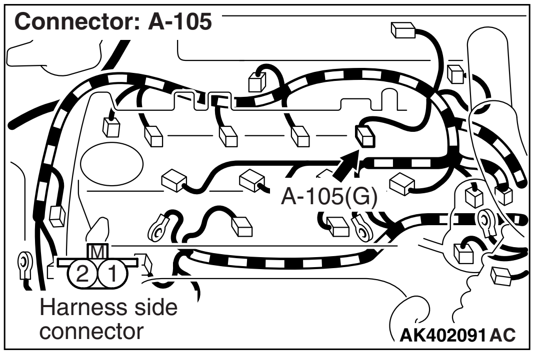
Q: Is the check result normal?

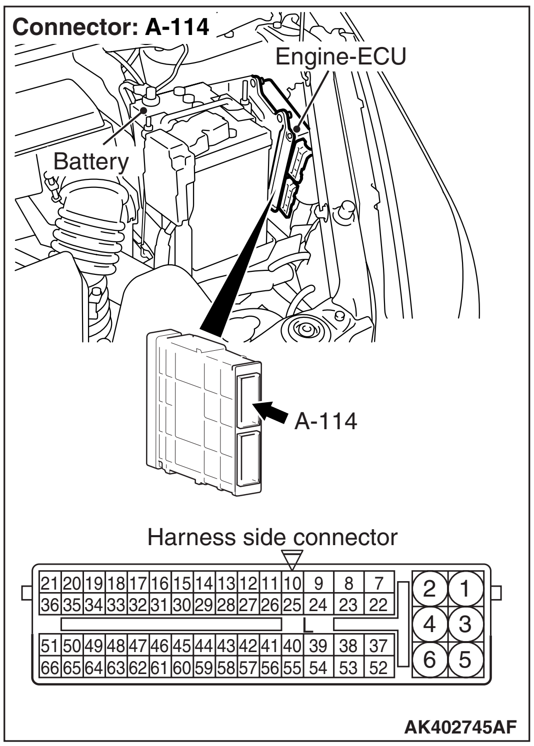
YES : Go to Step 6 .

NO : Repair the damaged harness wire.

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STEP 6. Check harness between A-105 (terminal No. 2) No. 4 injector connector and A-114 (terminal No. 24) engine-ECU connector.





- Check earthing line for damage.

Q: Is the check result normal?

YES : Go to Step 7 .

NO : Repair the damaged harness wire.

STEP 7. Fuel pressure measurement.

- Fuel pressure measurement (Refer to Fuel Pressure Test P.13B-358).

Q: Is the check result normal?

YES : Go to Step 8 .

NO : Repair the fuel pressure.

STEP 8. M.U.T.-III diagnosis code.

- Reconfirmation of diagnosis code.

Q: Is the diagnosis code set?

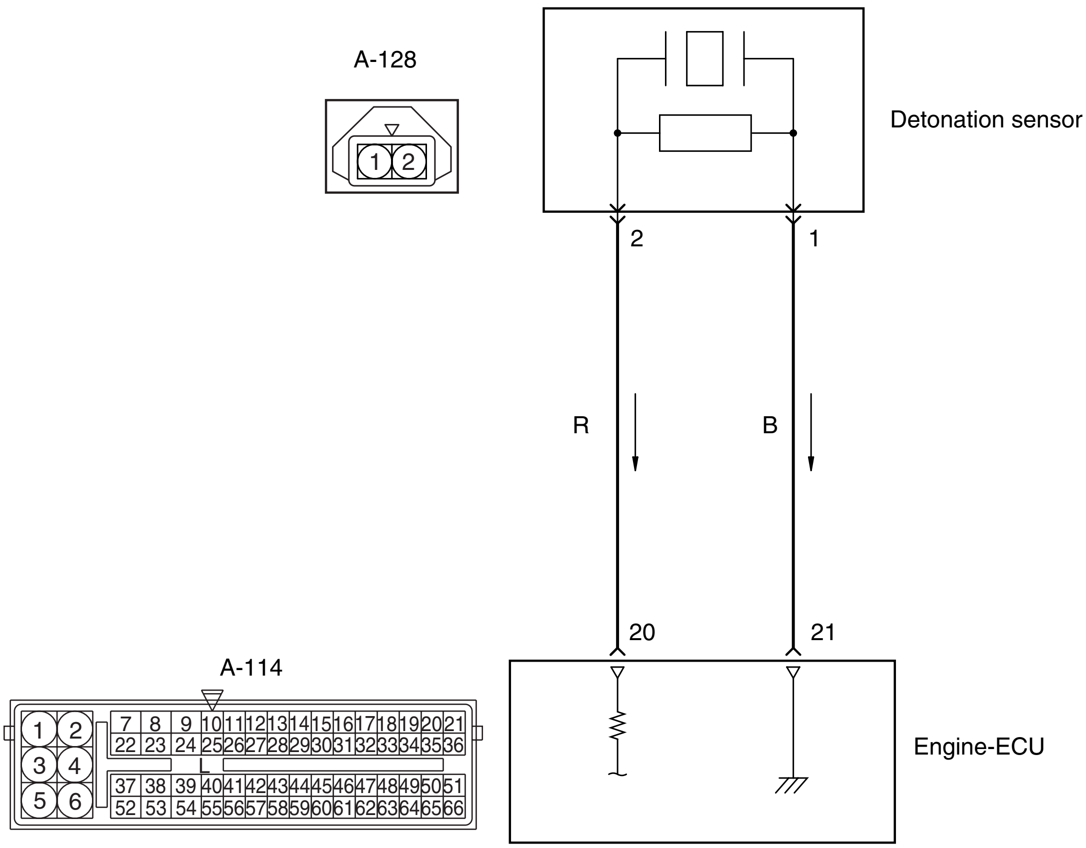
YES : Replace engine-ECU.

NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

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Code No. P0325: Detonation Sensor System

Detonation Sensor Circuit



Wire colour code
B: Black LG: Light green G: Green L: Blue W: White Y: Yellow SB: Sky blue BR: Brown O: Orange GR: Gray
R: Red P: Pink V: Violet P: Purple

AK402688 AD

OPERATION

- The sensor signal is input to the engine-ECU (terminal No. 20) from the detonation sensor (terminal No. 2).

FUNCTION

- The detonation sensor detects vibration of the cylinder block resulting from knocking and inputs a signal to the engine-ECU.
- In response to the signal, the engine-ECU provides ignition-timing retarding control while knocking condition persists.

TROUBLE JUDGEMENT

Check Conditions

- 2 seconds later from when engine starts
- Engine speed is more than 2,500 r/min.
- The volume efficiency is more than a prescribed value.

Judgement Criterion

- When the amount of the change of continuousness 200 times and the knock sensor output voltages is minute.

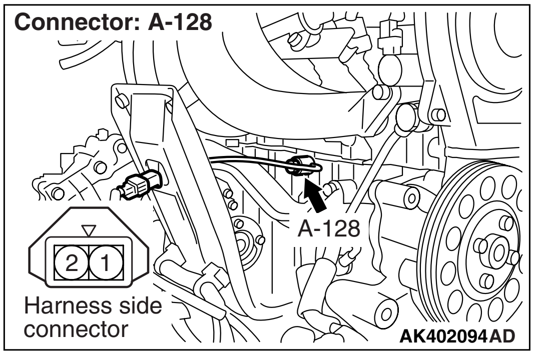
PROBABLE CAUSES

- Failed detonation sensor
- Open/short circuit in or damage to detonation sensor circuit, or loose connector contact
- Failed engine-ECU

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DIAGNOSIS PROCEDURE

STEP 1. Connector check: A-128 detonation sensor connector

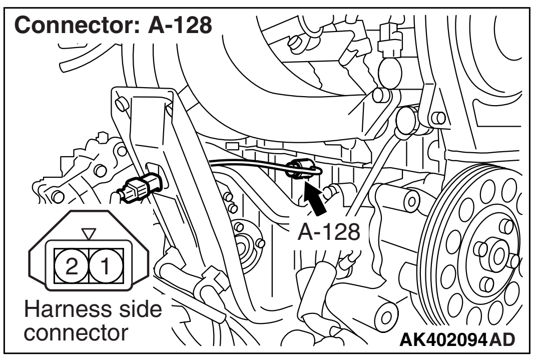


Q: Is the check result normal?

YES : Go to Step 2 .

NO : Repair or replace.

STEP 2. Perform resistance measurement at A-128 detonation sensor connector.



- Disconnect connector and measure at harness side.
- Resistance between terminal No. 1 and earth.

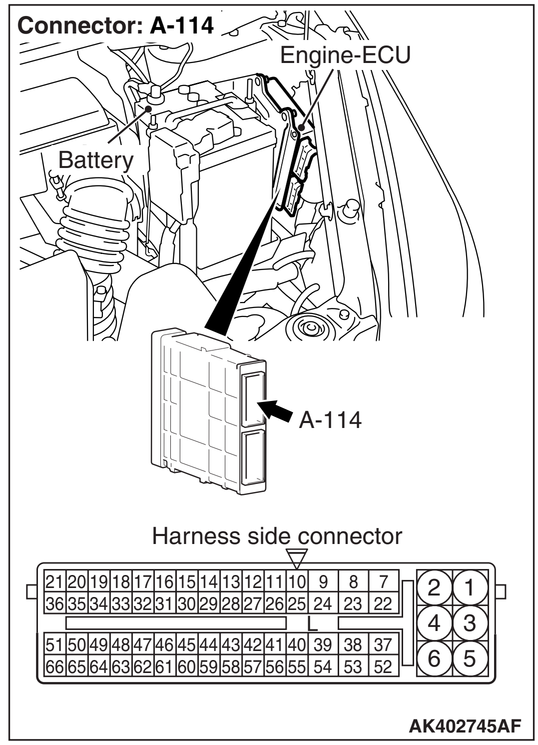
OK: Continuity (2 Ω or less)

Q: Is the check result normal?

YES : Go to Step 4 .

NO : Go to Step 3 .

STEP 3. Connector check: A-114 engine-ECU connector



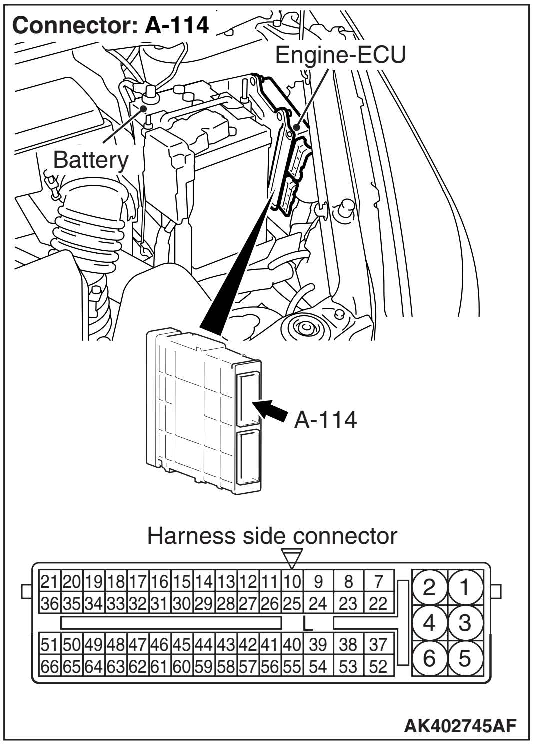
Q: Is the check result normal?

YES : Check and repair if necessary the harness between A-128 (terminal No. 1) detonation sensor connector and A-114 (terminal No. 21) engine-ECU connector.

NO : Repair or replace.

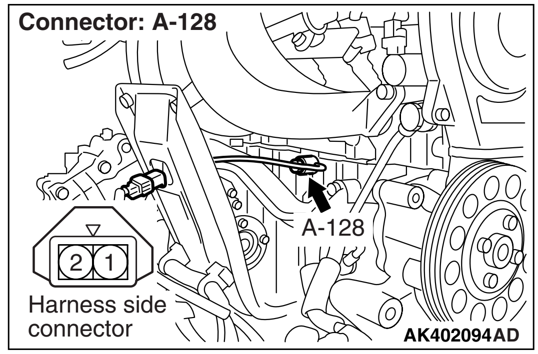
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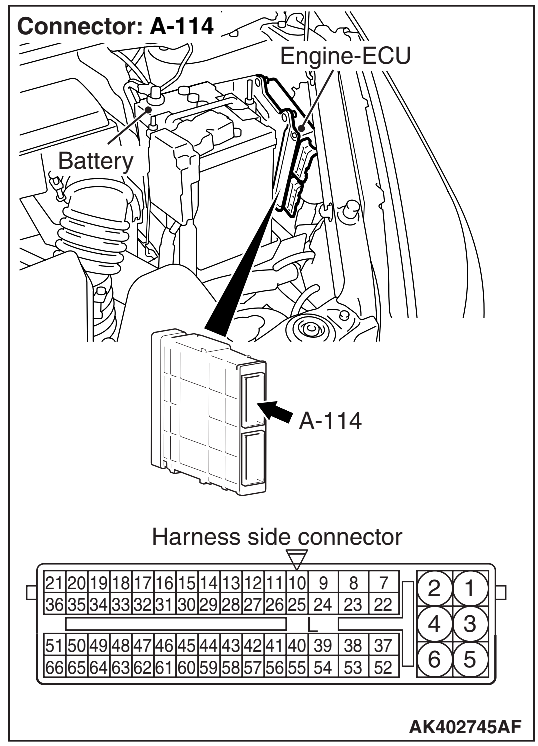
STEP 4. Connector check: A-114 engine-ECU connector



Q: Is the check result normal?
YES : Go to Step 5 .
NO : Repair or replace.

STEP 5. Check harness between A-128 (terminal No. 2) detonation sensor connector and A-114 (terminal No. 20) engine-ECU connector.





- Check output line for open/short circuit and damage.

Q: Is the check result normal?
YES : Go to Step 6 .
NO : Repair.

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STEP 6. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Q: Is the diagnosis code set?

YES : Go to Step 7 .

NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

STEP 7. Reconfirm the diagnosis code after replacing the detonation sensor.

- Reconfirm the diagnosis code after replacing the detonation sensor.

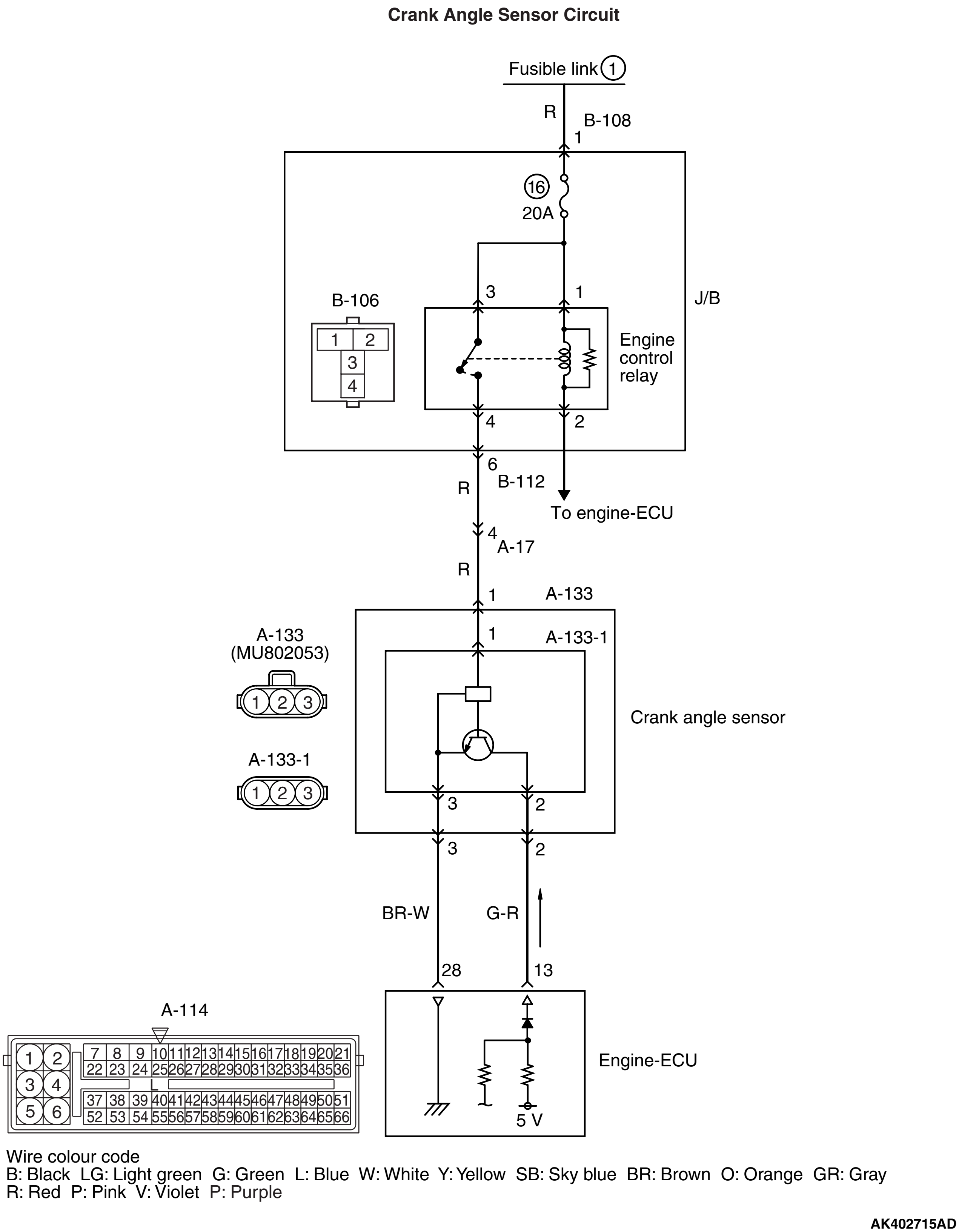
Q: Is the diagnosis code set?

YES : Replace the engine-ECU.

NO : Check end.

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Code No. P0335: Crank Angle Sensor System



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OPERATION

- Power is supplied to the crank angle sensor (terminal No. 1) by way of the engine control relay (terminal No. 4) and is earthed to the engine-ECU (terminal No. 28) through the crank angle sensor (terminal No. 3).
- A power voltage of 5 V is applied to the crank angle sensor (terminal No. 2) from the engine-ECU (terminal No. 13).

FUNCTION

- The crank angle sensor detects crankshaft angular position and provides the engine-ECU with a pulse signal.
- Using the signal, the engine-ECU performs injector and other control.

TROUBLE JUDGEMENT

Check Condition

- Ignition switch is in "ON" position.

Judgement Criterions

- Pulse signal from crank angle sensor continues 264 times and engine speed is less than 440 r/min.
- Crank angle sensor signal pattern is abnormal.

Check Condition

- Ignition switch is in "ON" position.

Judgement Criterion

- Crank angle sensor signal pattern is not normal for 4 seconds and engine speed is more than 440 r/min.

Check Condition

- While engine is being cranked.

Judgement Criterion

- Crank angle sensor output voltage does not vary for 4 seconds (no pulse signal input).

PROBABLE CAUSES

- Failed crank angle sensor
- Open/short circuit in or damage to crank angle sensor circuit, or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list

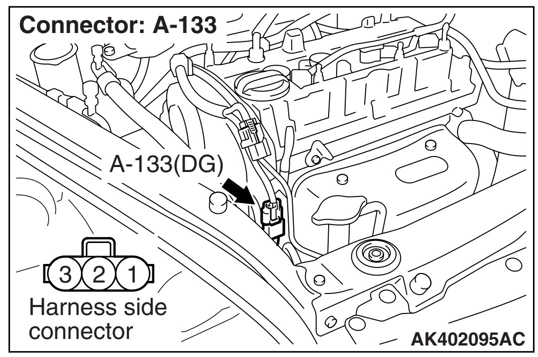
- Refer to Data List Reference Table P.13B-335.
  a. Item 22: Crank angle sensor

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

NO : Go to Step 2.

STEP 2. Connector check: A-133 crank angle sensor intermediate connector

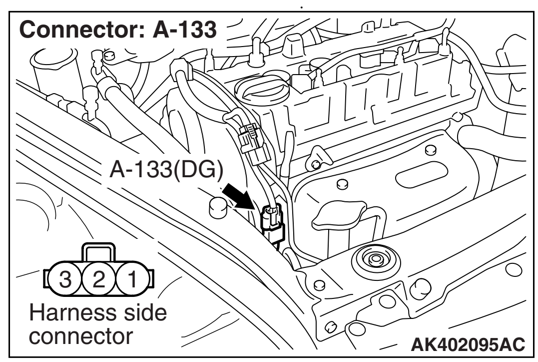


Q: Is the check result normal?

YES : Go to Step 3.

NO : Repair or replace.

STEP 3. Perform voltage measurement at A-133 crank angle sensor intermediate connector.



Disconnect the connector, and measure at harness side.

- Ignition switch: ON
- Voltage between terminal No. 2 and earth.

OK: 4.9 – 5.1 V

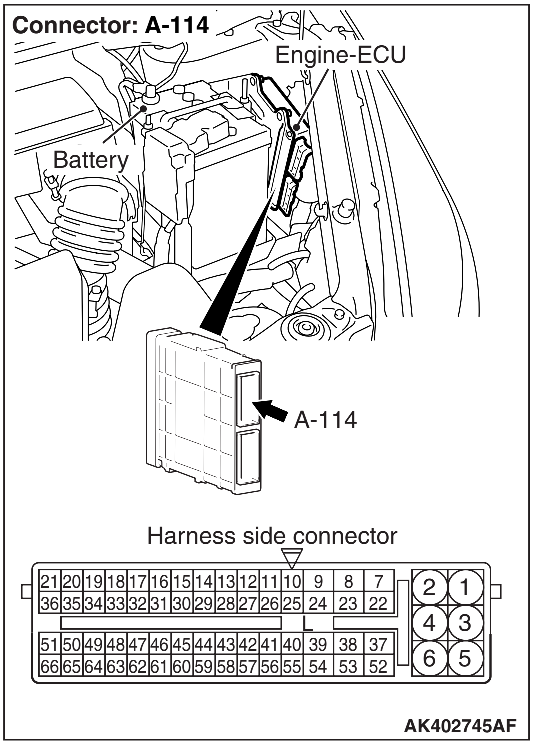
Q: Is the check result normal?

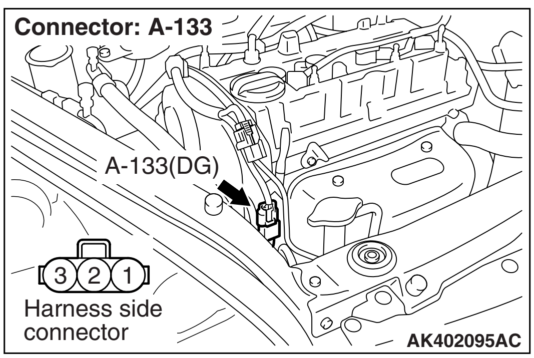
YES : Go to Step 9.

NO : Go to Step 4.

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STEP 4. Perform voltage measurement at A-114 engine-ECU connector.





Disconnect engine-ECU connector, and connect special tool power plant ECU check harness (MB991987), and then measure the voltage on the check connector.

- Disconnect the A-133 crank angle sensor intermediate connector.
- Ignition switch: ON
- Voltage between terminal No. 13 and earth.

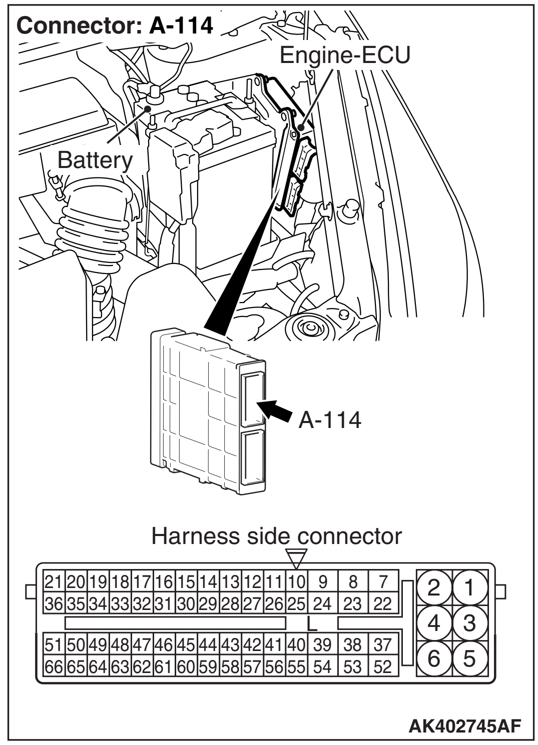
OK: 4.9 – 5.1 V

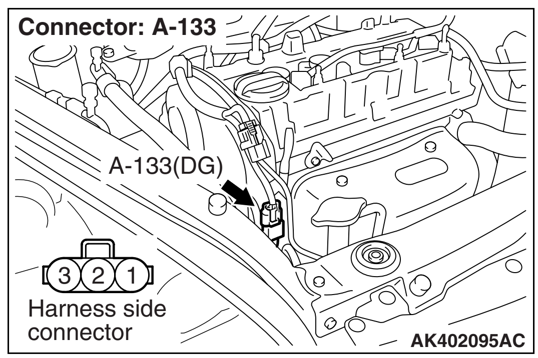
Q: Is the check result normal?

YES : Go to Step 5.

NO : Go to Step 6.

STEP 5. Connector check: A-114 engine-ECU connector





Q: Is the check result normal?

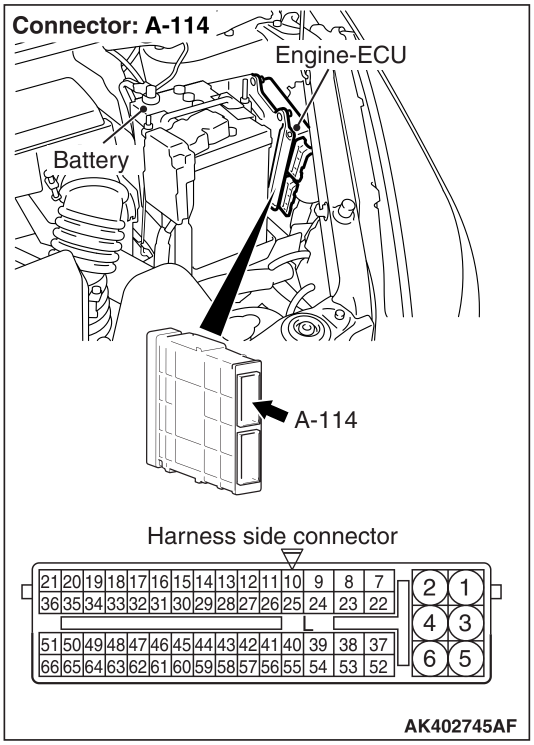
YES : Check and repair the harness between A-133 (terminal No. 2) crank angle sensor intermediate connector and A-114 (terminal No. 13) engine-ECU connector.

- Check output line for open circuit.

NO : Repair or replace.

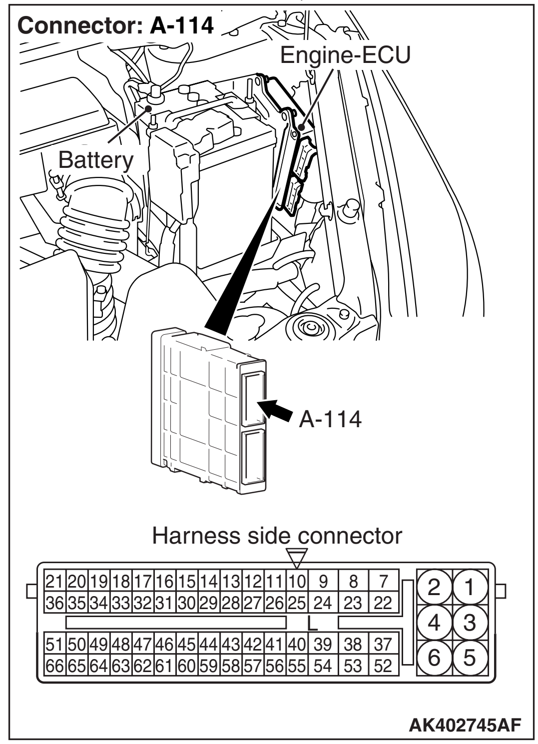
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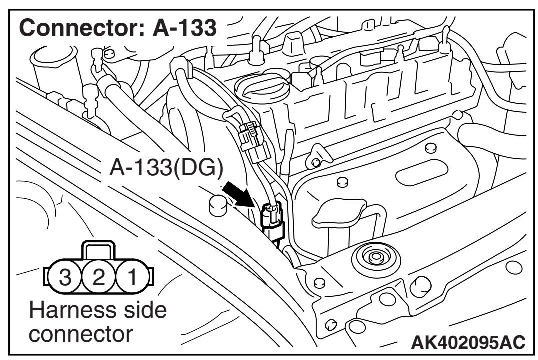
STEP 6. Connector check: A-114 engine-ECU connector



Q: Is the check result normal?
YES : Go to Step 7.
NO : Repair or replace.

STEP 7. Check harness between crank angle sensor intermediate connector A-133 (terminal No. 2) and engine-ECU connector A-114 (terminal No. 13).





Check the output line for short circuit.

Q: Is the check result normal?
YES : Go to Step 8.
NO : Repair.

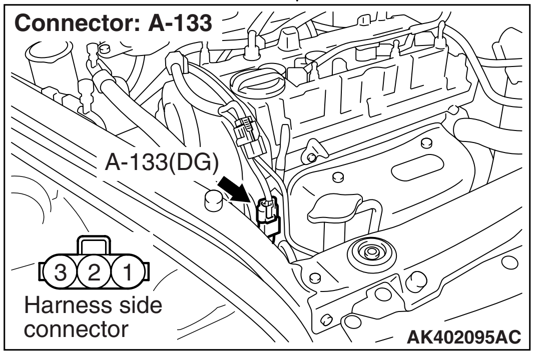
STEP 8. M.U.T.-III data list

- Refer to Data List Reference Table P.13B-335.
  a. Item 22: Crank angle sensor

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).
NO : Replace the engine-ECU.

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STEP 9. Perform voltage measurement at A-133 crank angle sensor intermediate connector.



Disconnect the connector, and measure at harness side.

- Ignition switch: ON
- Voltage between terminal No. 1 and earth.

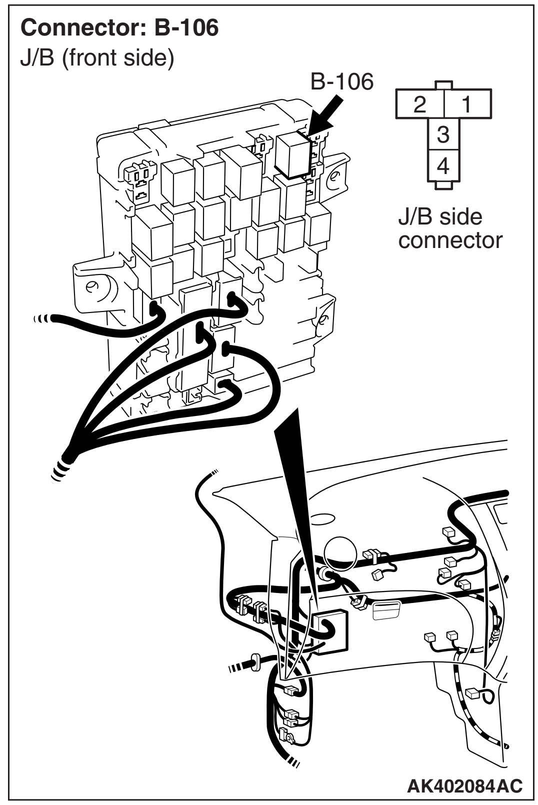
OK: System voltage

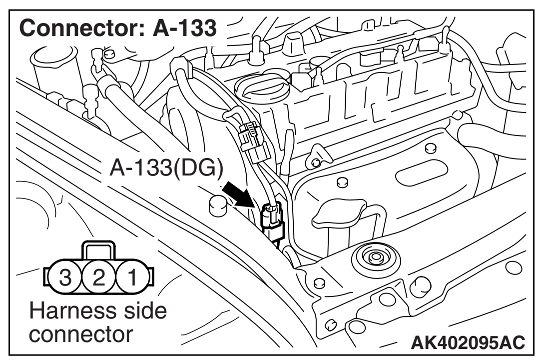
Q: Is the check result normal?

YES : Go to Step 11.

NO : Go to Step 10.

STEP 10. Connector check: B-106 engine control relay connector





Q: Is the check result normal?

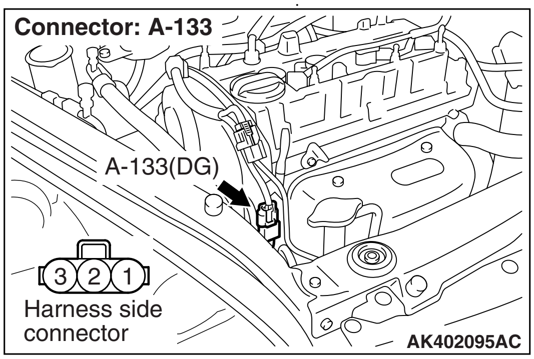
YES : Check the intermediate connectors A-17 and B-112, and repair them if necessary. If the intermediate connectors are normal, check and repair the harness between A-133 (terminal No. 1) crank angle sensor intermediate connector and B-106 (terminal No. 4) engine control relay connector.

- Check power supply line for open/short circuit.

NO : Repair or replace.

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STEP 11. Perform resistance measurement at A-133 crank angle sensor intermediate connector.



Disconnect the connector, and measure at harness side.

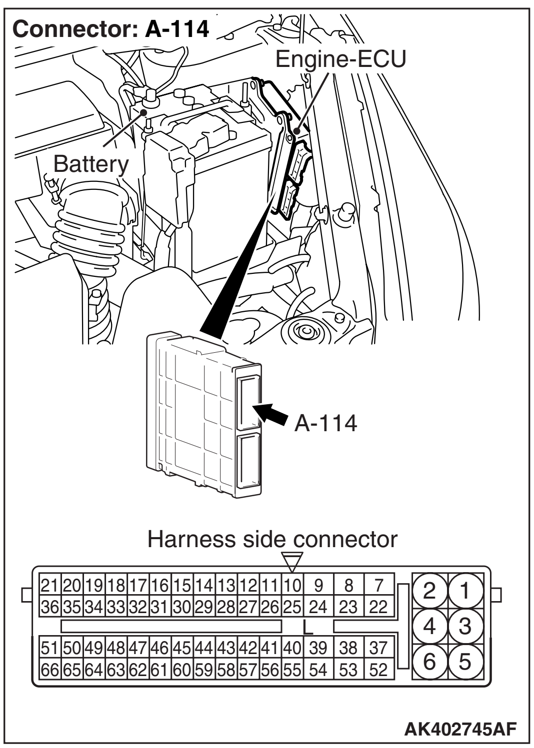
- Resistance between terminal No. 3 and earth.

OK: Continuity (2 Ω or less)

Q: Is the check result normal?

YES : Go to Step 15.
NO : Go to Step 12.

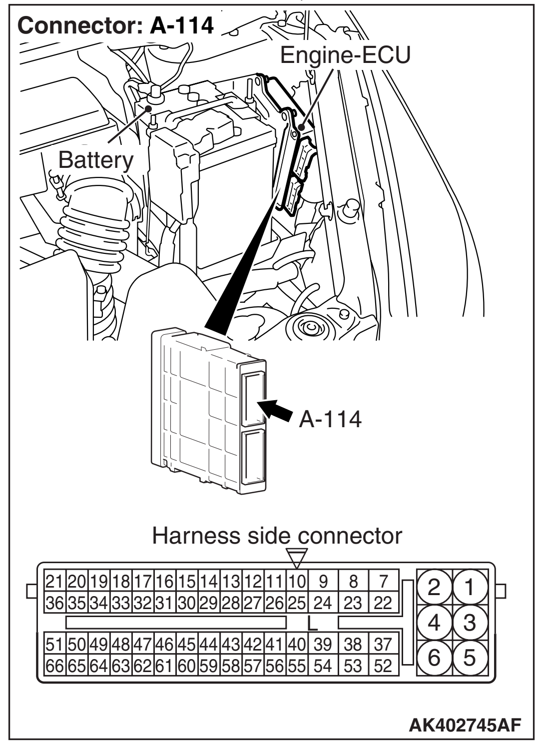
STEP 12. Connector check: A-114 engine-ECU connector

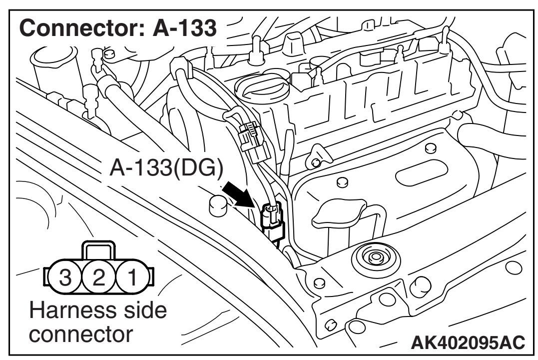


Q: Is the check result normal?

YES : Go to Step 13.
NO : Repair or replace.

STEP 13. Check harness between A-133 (terminal No. 3) crank angle sensor intermediate connector and A-114 (terminal No. 28) engine-ECU connector.





Check earthing line for open circuit and damage.

Q: Is the check result normal?

YES : Go to Step 14.
NO : Repair.

STEP 14. M.U.T.-III data list

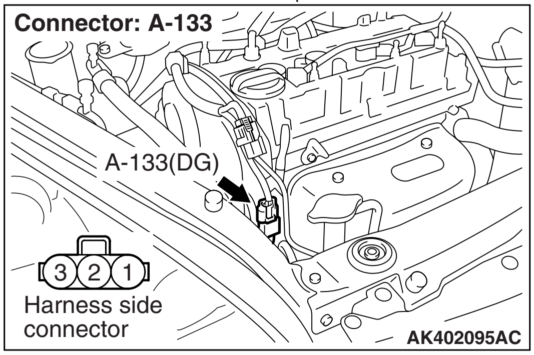
- Refer to Data List Reference Table P.13B-335.
  a. Item 22: Crank angle sensor

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points –How to Cope with Intermittent Malfunctions P.00-13).
NO : Replace the engine-ECU.

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STEP 15. Perform output waveform check at A-133 crank angle sensor intermediate connector (using an oscilloscope)



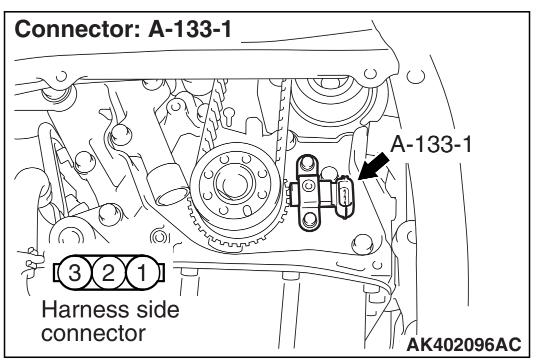
Use special tool test harness (MB991658) to connect connector, and measure at pick-up harness.

- Engine: Idling
- Transmission: Neutral
- Voltage between terminal No. 2 and earth.

OK: Waveforms should be displayed on inspection procedure using an oscilloscope (Refer to P.13B-352), its maximum value should be 4.8 V or more, and its minimum value should be 0.6 V or less with no noise in waveform.

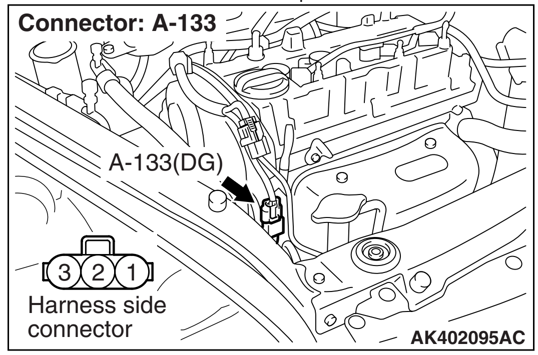
Q: Is the check result normal?
YES : Go to Step 16.
NO : Go to Step 23.

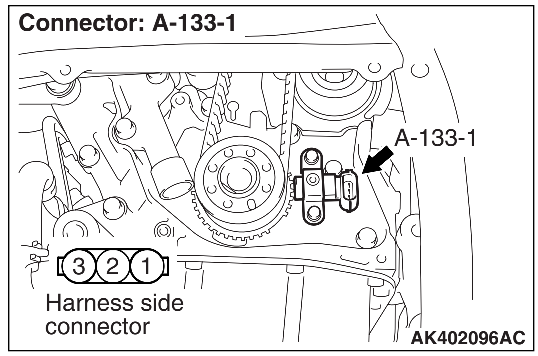
STEP 16. Connector check: A-133-1 crank angle sensor connector



Q: Is the check result normal?
YES : Go to Step 17.
NO : Repair or replace.

STEP 17. Check harness between A-133-1 crank angle sensor connector and A-133 crank angle sensor intermediate connector.





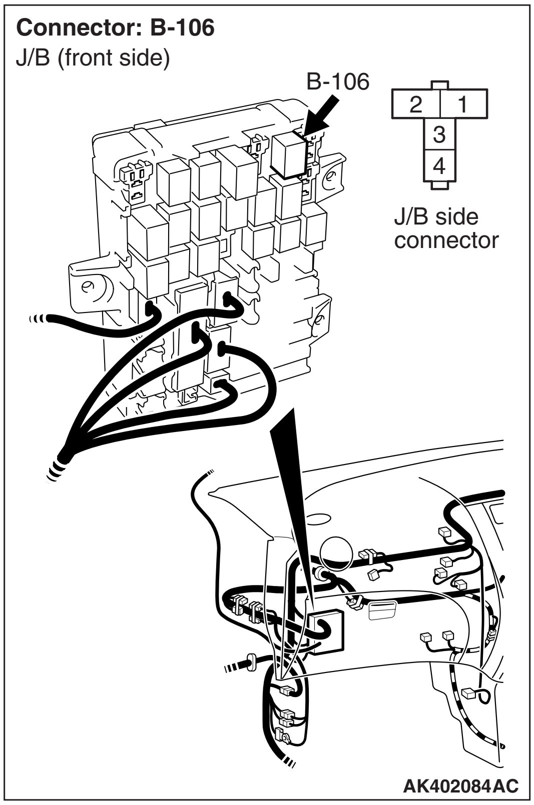
Check the power supply line for open/short circuit and damage.

- Check the output line for open/short circuit and damage.
- Check earthing line for open circuit and damage.

Q: Is the check result normal?
YES : Go to Step 18.
NO : Replace the timing belt cover.

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STEP 18. Connector check: B-106 engine control relay connector

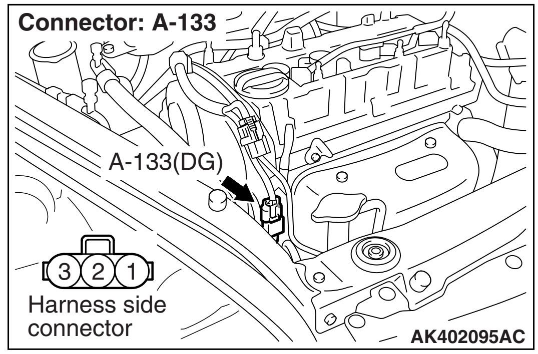


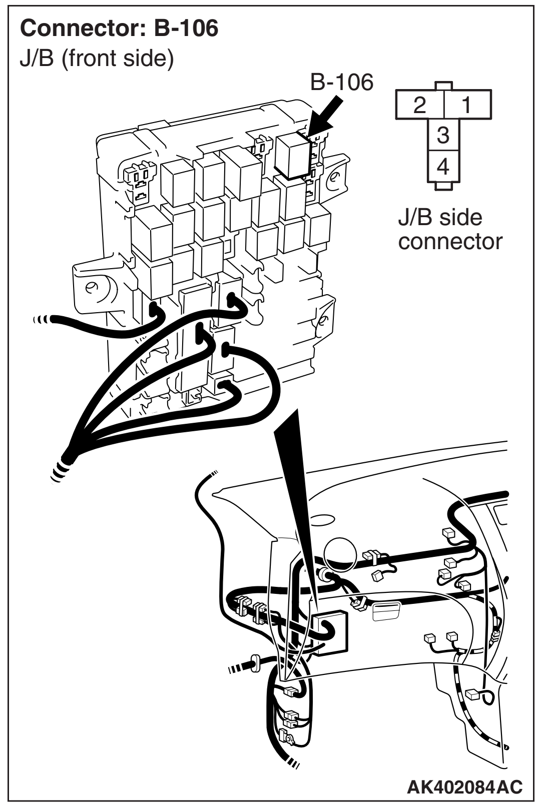
Q: Is the check result normal?

YES : Go to Step 19.

NO : Repair or replace.

STEP 19. Check harness between A-133 (terminal No. 1) crank angle sensor intermediate connector and B-106 (terminal No. 4) engine control relay connector.





NOTE: Before checking harness, check intermediate connectors A-17 and B-112, and repair if necessary.

- Check power supply line for damage.

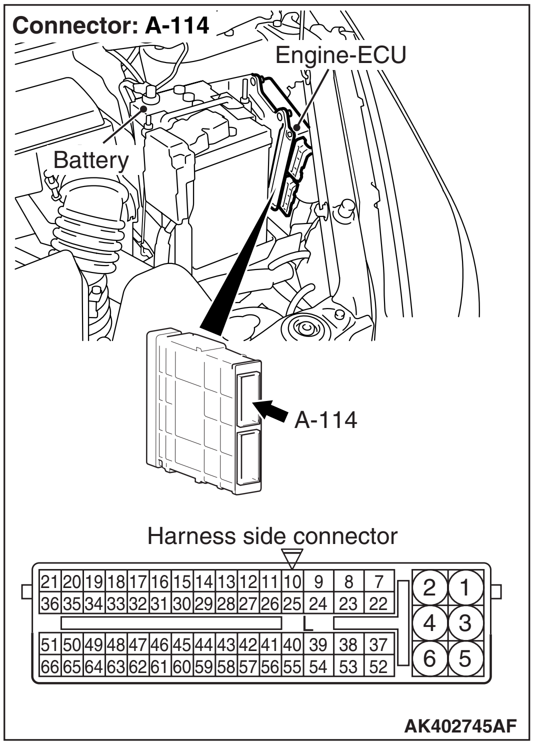
Q: Is the check result normal?

YES : Go to Step 20.

NO : Repair.

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STEP 20. Connector check: A-114 engine-ECU connector

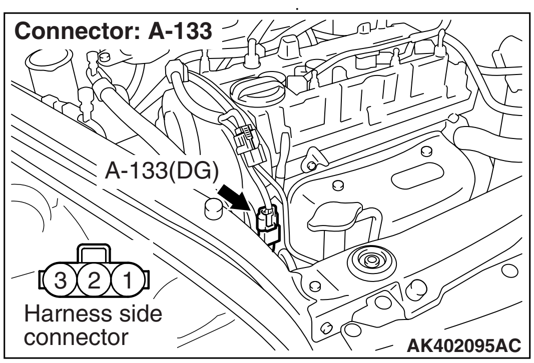


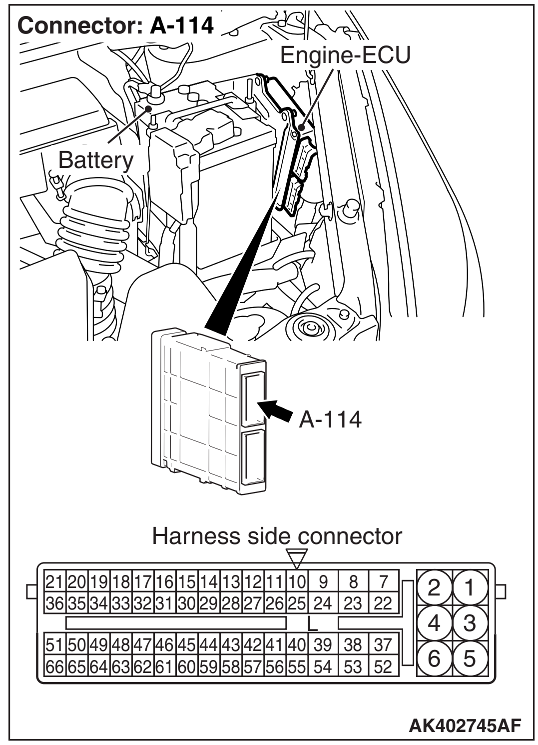
Q: Is the check result normal?

YES : Go to Step 21.

NO : Repair or replace.

STEP 21. Check harness between A-133 (terminal No. 2) crank angle sensor intermediate connector and A-114 (terminal No. 13) engine-ECU connector.





Check output line for damage.

Q: Is the check result normal?

YES : Go to Step 22.

NO : Repair.

STEP 22. Check crank angle sensor sensing blade.

Q: Is the check result normal?

YES : Replace the crank angle sensor.

NO : Replace the crank angle sensor blade.

STEP 23. M.U.T.-III data list

- Refer to Data List Reference Table P.13B-335.
  a. Item 22: Crank angle sensor

Q: Is the check result normal?

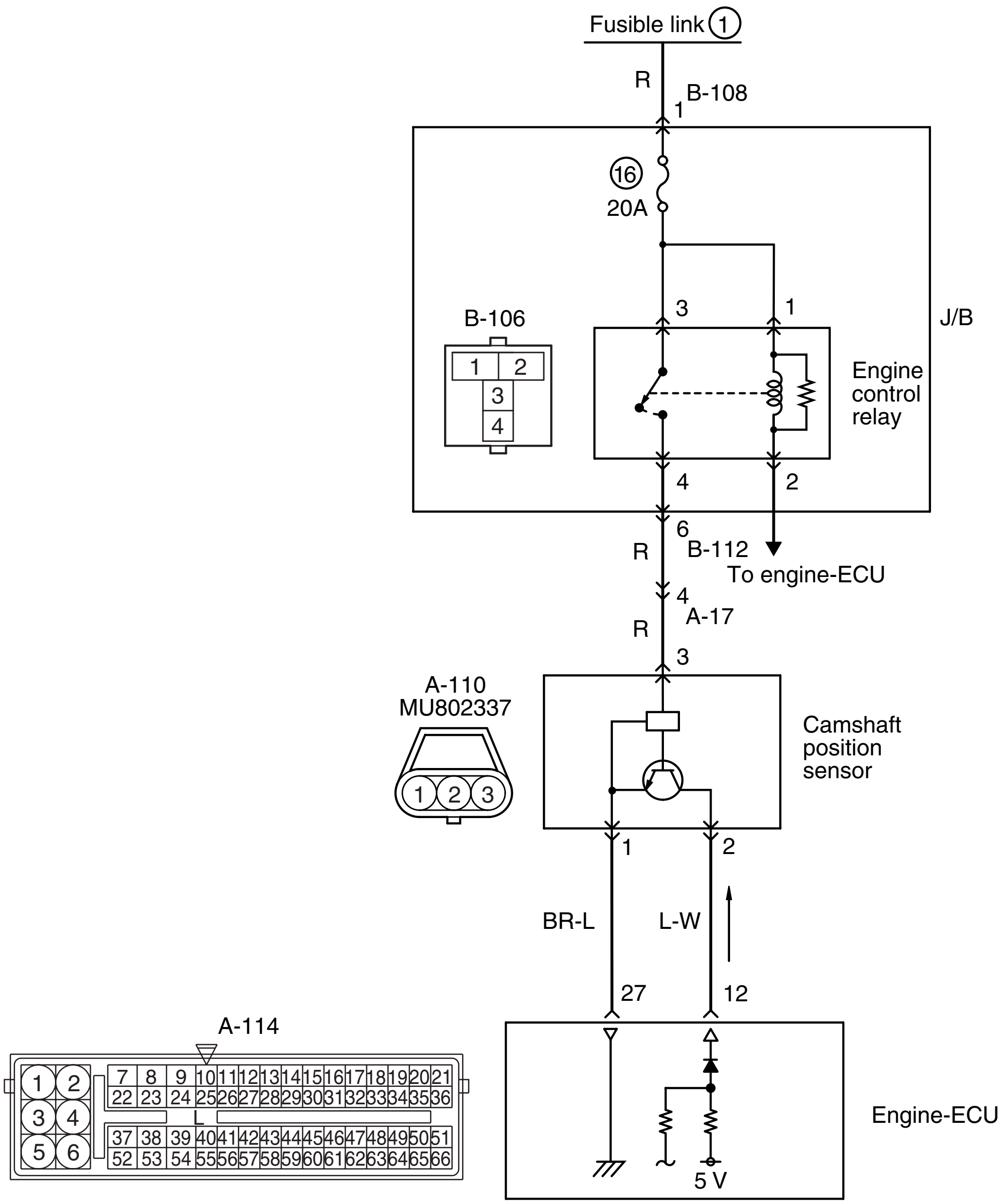
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

NO : Replace the engine-ECU.

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Code No. P0340: Camshaft Position Sensor System

Camshaft Position Sensor Circuit



Wire colour code
B: Black LG: Light green G: Green L: Blue W: White Y: Yellow SB: Sky blue BR: Brown O: Orange GR: Gray
R: Red P: Pink V: Violet P: Purple

AK402690AF

OPERATION

- Power is supplied to the camshaft position sensor (terminal No. 3) from the engine control relay (terminal No. 4) and is earthed to the engine-ECU (terminal No. 27) through the camshaft position sensor (terminal No. 1).
- A power voltage of 5 V is applied to the camshaft position sensor (terminal No. 2) from the engine-ECU (terminal No. 12).

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FUNCTION

- The camshaft position sensor detects the top dead center on the compression stroke of No. 1 cylinder and provides the engine-ECU with a pulse signal.

TROUBLE JUDGEMENT

Check Condition

- Ignition switch is in "ON" position.

Judgement Criterions

- Pulse signal from crank angle sensor continues 264 times and engine speed is less than 440 r/min.
- Crank angle sensor signal pattern is abnormal.

Check Condition

- Ignition switch is in "ON" position.

Judgement Criterion

- Crank angle sensor signal pattern is not normal for 4 seconds and engine speed is more than 440 r/min.

Check Condition

- While engine is being cranked.

Judgement Criterion

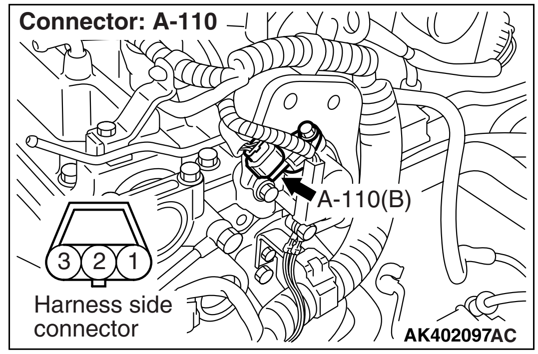
- Crank angle sensor output voltage does not vary for 4 seconds (no pulse signal input).

PROBABLE CAUSES

- Failed camshaft position sensor
- Open/short circuit in or damage to camshaft position sensor circuit, or loose connector contact
- Failed engine-ECU

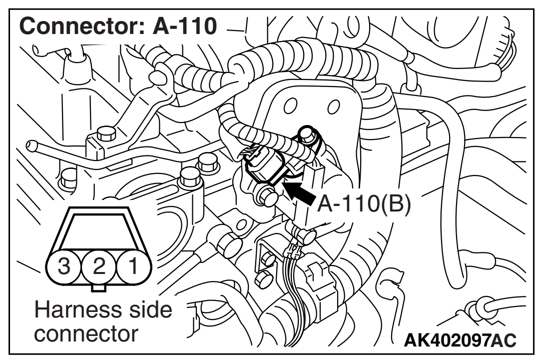
DIAGNOSIS PROCEDURE

STEP 1. Connector check: A-110 camshaft position sensor connector



Q: Is the check result normal?
YES : Go to Step 2.
NO : Repair or replace.

STEP 2. Perform voltage measurement at A-110 camshaft position sensor connector.

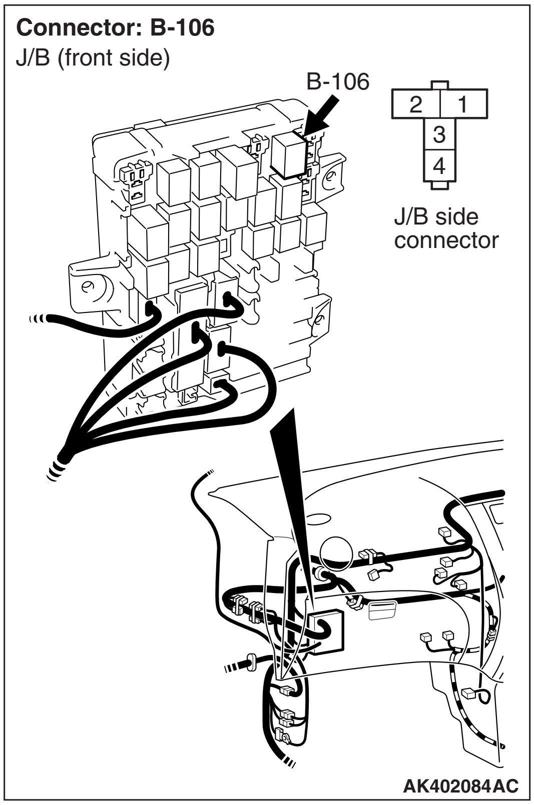


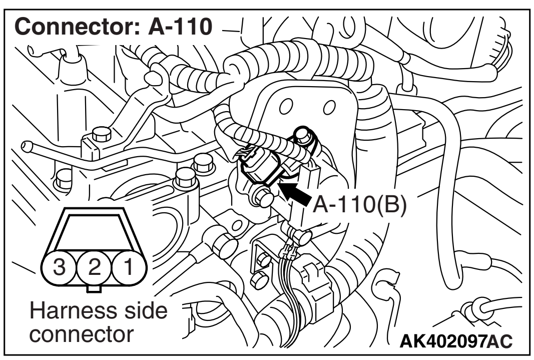
- Disconnect connector and measure at harness side.
- Ignition switch: ON
- Voltage between terminal No. 3 and earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 4.
NO : Go to Step 3.

STEP 3. Connector check: B-106 engine control relay connector



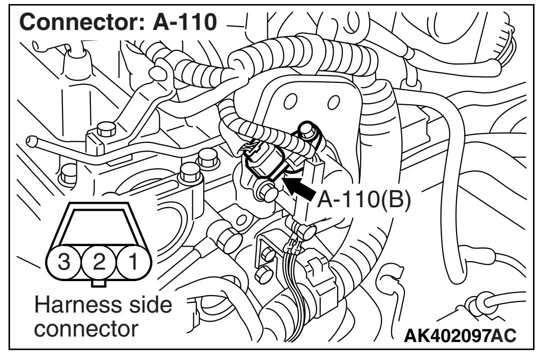


Q: Is the check result normal?

YES : Check intermediate connectors A-17 and B-112, and repair them if necessary. If the intermediate connectors are normal, check and repair the harness between A-110 (terminal No. 3) camshaft position sensor connector and B-106 (terminal No. 4) engine control relay connector.
- Check power supply line for open/short circuit.

NO : Repair or replace.

STEP 4. Perform voltage measurement at A-110 camshaft position sensor connector.



- Disconnect connector and measure at harness side.
- Ignition switch: ON
- Voltage between terminal No. 2 and earth.

OK: 4.9 – 5.1 V

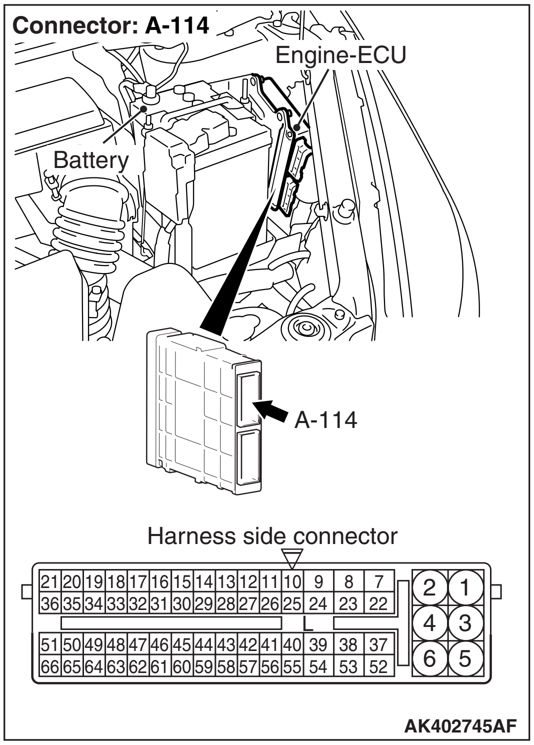
Q: Is the check result normal?

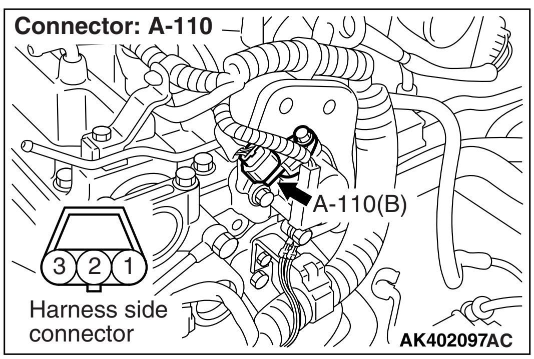
YES : Go to Step 10.

NO : Go to Step 5.

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STEP 5. Perform voltage measurement at A-114 engine-ECU connector.





- Disconnect engine-ECU connector, and connect special tool power plant ECU check harness (MB991987), and then measure the voltage at the check connector.
- Disconnect the A-110 camshaft position sensor connector.
- Ignition switch: ON
- Voltage between terminal No. 12 and earth.

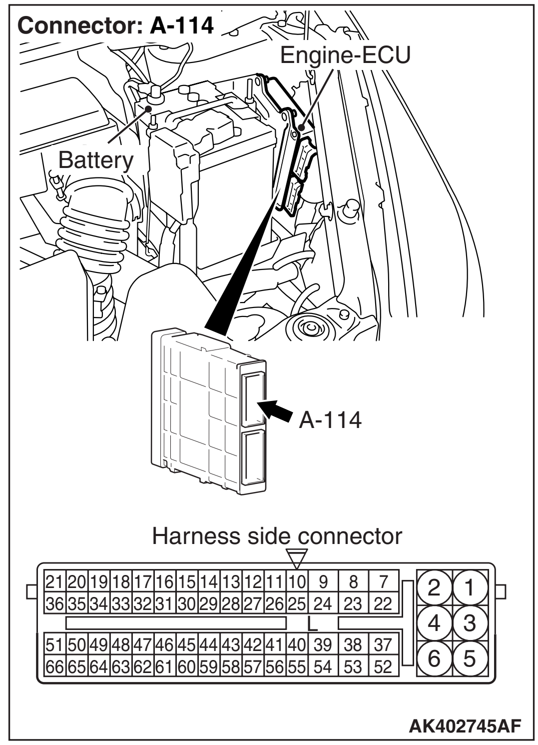
OK: 4.9 – 5.1 V

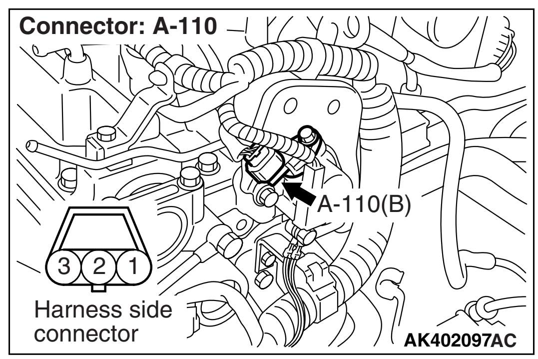
Q: Is the check result normal?

YES : Go to Step 6.

NO : Go to Step 7.

STEP 6. Connector check: A-114 engine-ECU connector





Q: Is the check result normal?

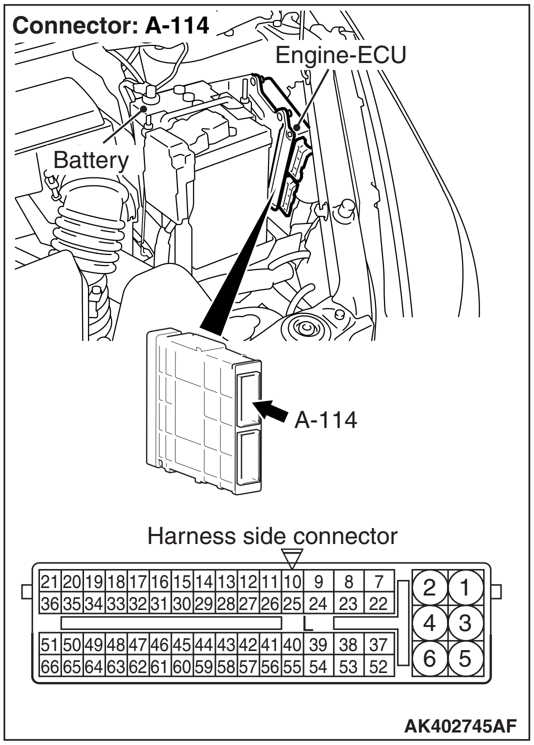
YES : Check and repair the harness between A-110 (terminal No. 2) camshaft position sensor connector and A-114 (terminal No. 12) engine-ECU connector.

- Check output line for open circuit.

NO : Repair or replace.

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STEP 7. Connector check: A-114 engine-ECU connector

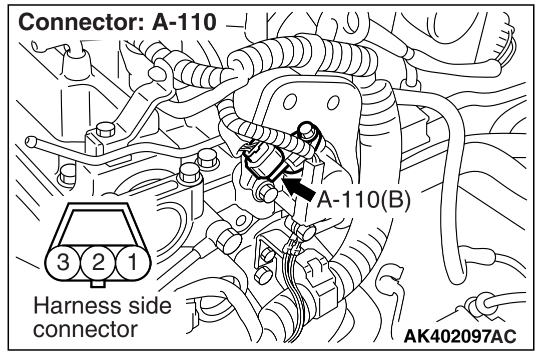


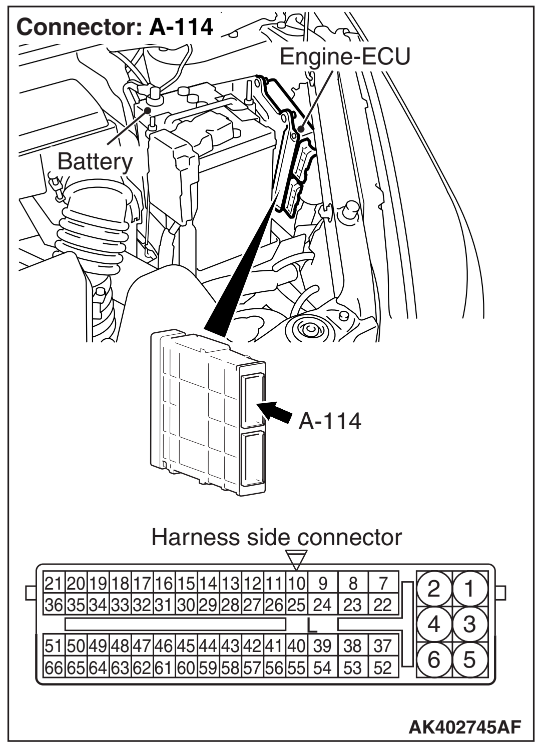
Q: Is the check result normal?

YES : Go to Step 8.

NO : Repair or replace.

STEP 8. Check harness between A-110 (terminal No. 2) camshaft position sensor connector and A-114 (terminal No. 12) engine-ECU connector.





- Check the output line for short circuit.

Q: Is the check result normal?

YES : Go to Step 9.

NO : Repair.

STEP 9. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

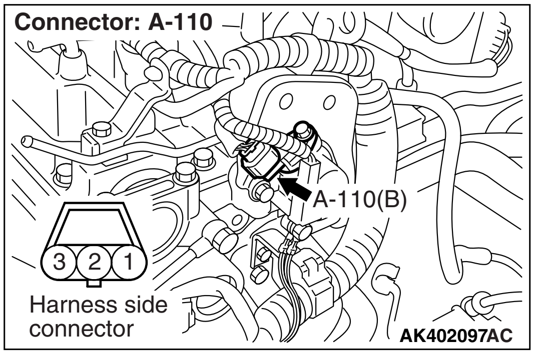
Q: Is the diagnosis code output?

YES : Replace the engine-ECU.

NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

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STEP 10. Perform resistance measurement at A-110 camshaft position sensor connector.

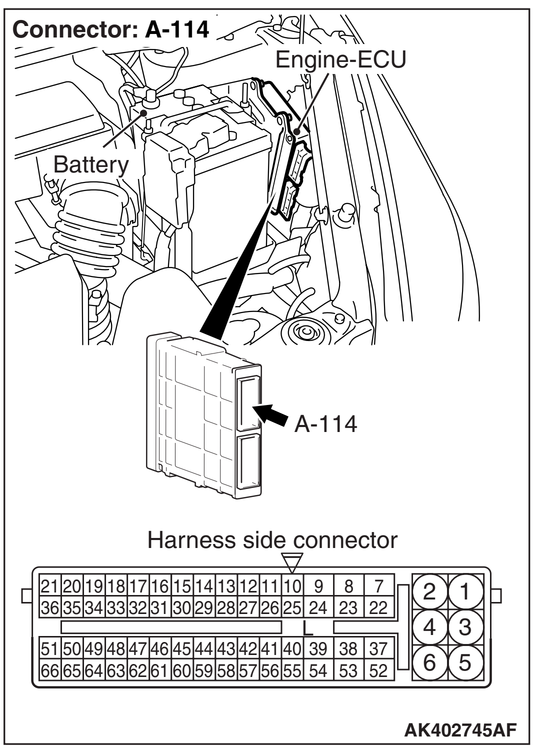


- Disconnect connector and measure at harness side.
- Voltage between terminal No. 1 and earth.

OK: Continuity (2 Ω or less)

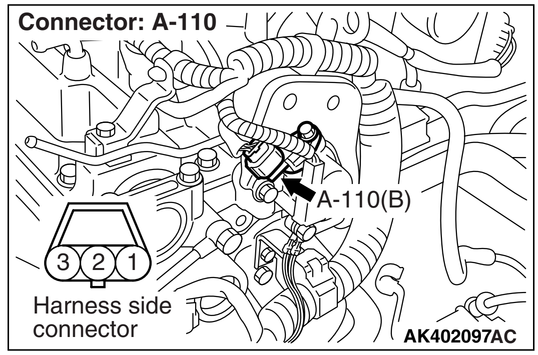
Q: Is the check result normal?
YES : Go to Step 13.
NO : Go to Step 11.

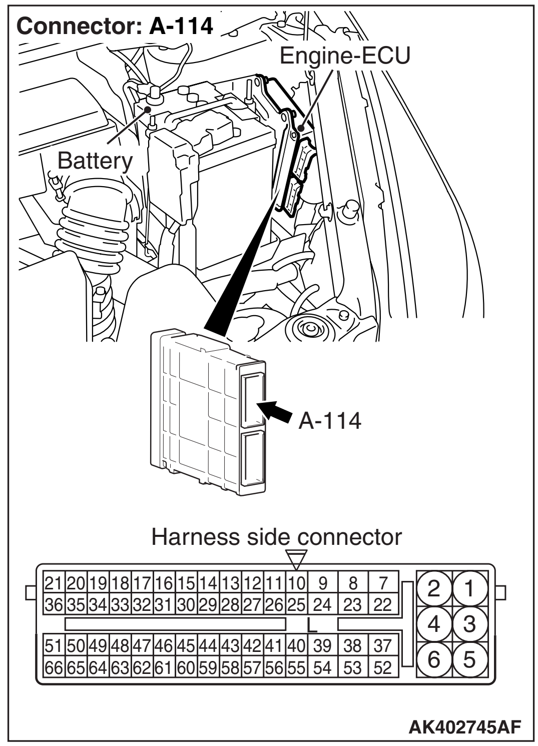
STEP 11. Connector check: A-114 engine-ECU connector



Q: Is the check result normal?
YES : Go to Step 12.
NO : Repair or replace.

STEP 12. Check harness between A-110 (terminal No. 1) camshaft position sensor connector and A-114 (terminal No. 27) engine-ECU connector.



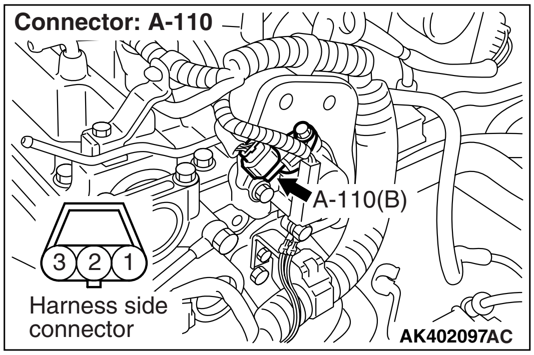


- Check earthing line for open circuit and damage.

Q: Is the check result normal?
YES : Go to Step 9.
NO : Repair.

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STEP 13. Perform output waveform check at A-110 camshaft position sensor connector (using an oscilloscope).

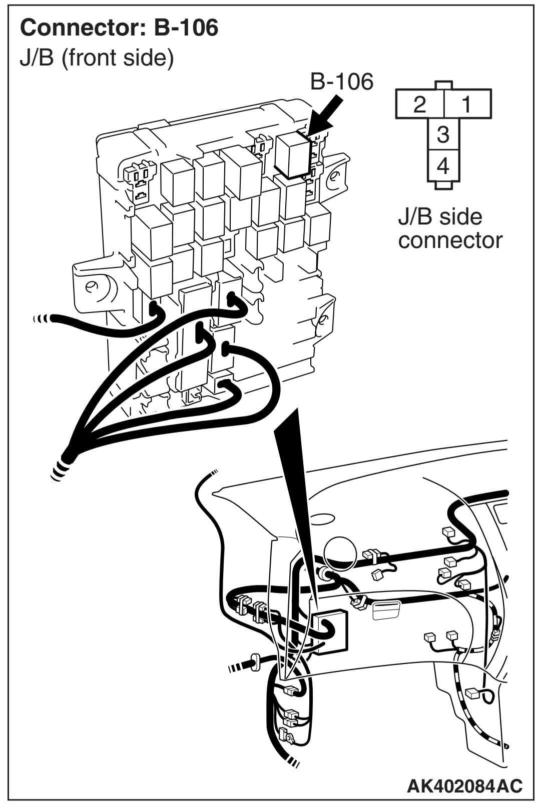


- Use the special tool test harness (MB991709) to connect the connector, and measure at the pick-up harness.
- Engine: Idling
- Transmission: Neutral
- Voltage between terminal No. 2 and earth.

OK: Waveforms should be displayed on Inspection procedure using an oscilloscope (Refer to P.13B-352), its maximum value should be 4.8 V or more, and its minimum valve should be 0.6 V or less with no noise in waveform.

Q: Is the check result normal?
YES : Go to Step 9.
NO : Go to Step 14.

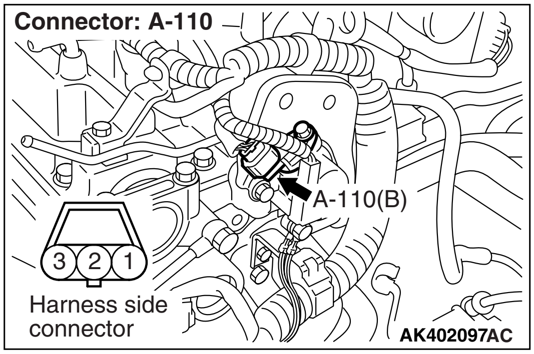
STEP 14. Connector check: B-106 engine control relay connector

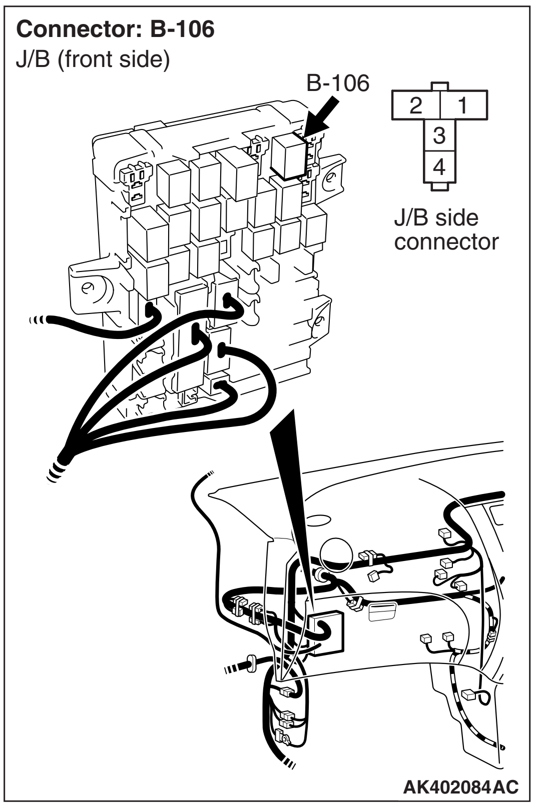


Q: Is the check result normal?
YES : Go to Step 15.
NO : Repair or replace.

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STEP 15. Check harness between A-110 (terminal No. 3) camshaft position sensor connector and B-106 (terminal No. 4) engine control relay connector.

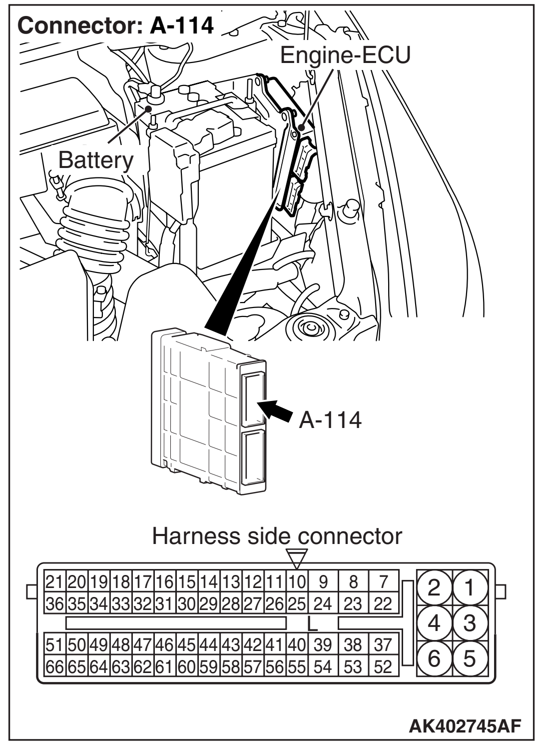




- Check power supply line for damage.

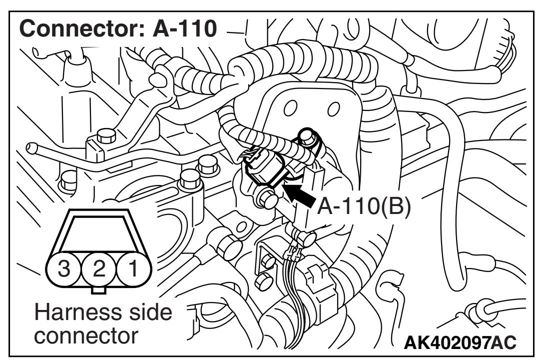
Q: Is the check result normal?
YES : Go to Step 16.
NO : Repair.

STEP 16. Connector check: A-114 engine-ECU connector

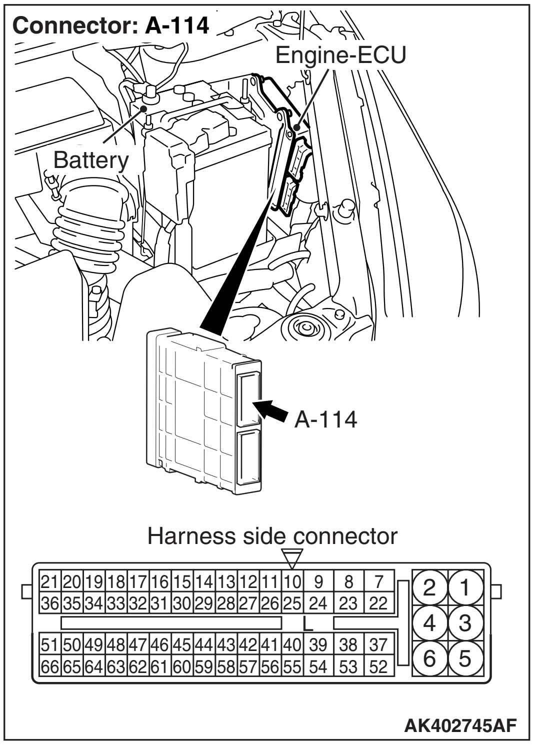


Q: Is the check result normal?
YES : Go to Step 17.
NO : Repair or replace.

STEP 17. Check harness between A-110 (terminal No. 2) camshaft position sensor connector and A-114 (terminal No. 12) engine-ECU connector.

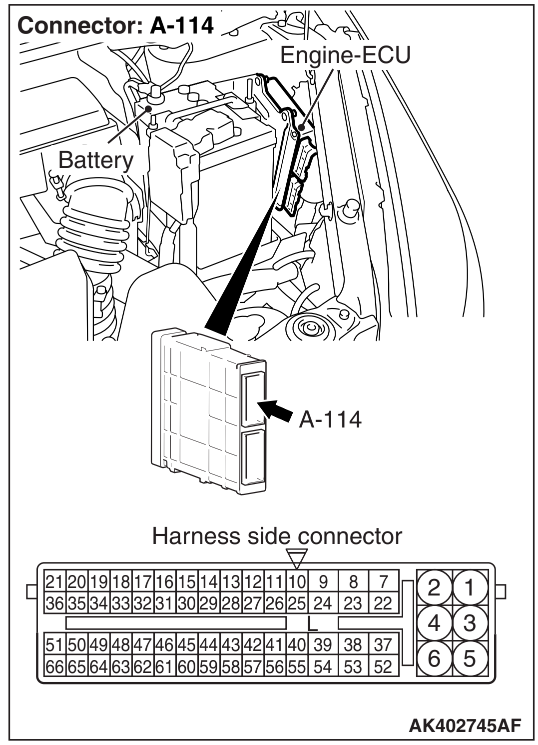


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- Check output line for damage.

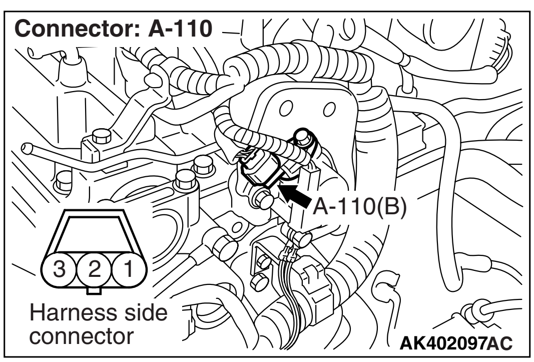
Q: Is the check result normal?
YES : Go to Step 18.
NO : Repair.



- Check earthing line for damage.

Q: Is the check result normal?
YES : Go to Step 19.
NO : Repair.

STEP 18. Check harness between A-110 (terminal No. 1) camshaft position sensor connector and A-114 (terminal No. 27) engine-ECU connector.



STEP 19. Check camshaft position sensing cylinder.

Q: Is the check result normal?
YES : Go to Step 20.
NO : Replace the camshaft position sensing cylinder.

STEP 20. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Q: Is the diagnosis code output?
YES : Replace camshaft position sensor.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

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Code No. P0421: Warm Up Catalyst Malfunction

FUNCTION

- The signal from the oxygen sensor (rear) differs from the oxygen sensor (front). That is because the catalytic converter purifies exhaust gas. When the catalytic converter has deteriorated, the signal from the oxygen sensor (front) becomes similar to the oxygen sensor (rear).
- The engine-ECU compares the output of the front and rear oxygen sensor signals.

TROUBLE JUDGMENT

Check Conditions

- The accelerator pedal is depressed.
- Engine speed is 3,000 r/min or lower.
- Air flow sensor output is 6 g/s or higher.
- 3 seconds or more elapsed after the abovementioned conditions were satisfied.
- Within the range of air-fuel ratio feed back operation
- Short-term fuel trim is more than -25% and is less than 15%
- Vehicle speed is 1.5 km/h or higher.
- For 10 seconds per cycle, the engine-ECU monitors 7 cycles of this condition during the drive cycle.
- The cumulative air flow sensor output is more than a prescribed value.

Judgement Criterion

- The oxygen sensor (rear) signal frequency divided by oxygen sensor (front) signal frequency is 0.8 or more.

PROBABLE CAUSE

- Catalytic converter deteriorated
- Failed oxygen sensor (front)
- Failed oxygen sensor (rear)
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Check for leakage of exhaust emission from exhaust manifold.

Q: Is the check result normal?
YES : Go to Step 2 .
NO : Repair.

STEP 2. M.U.T.-II/III data list

- Refer to data list reference table P.13B-335.
  a. Item 11: Oxygen sensor (front)
  b. Item 59: Oxygen sensor (rear)

Q: Is the check result normal?
YES : Go to Step 3 .
NO : Perform the diagnosis code classified check procedure for the sensor that has shown an abnormal data valve (Refer to Inspection Chart for diagnosis codes P.13B-18).

STEP 3. M.U.T.-II/III data list

- Refer to data list reference table P.13B-335.
  a. Item 11: Oxygen sensor (front)

  OK: 0 – 0.4 and 0.6 – 1.0 volt should alternate 15 times or more within 10 seconds (engine speed at 2,000 r/min).

Q: Is the check result normal?
YES : Go to Step 4 .
NO : Replace the oxygen sensor (front).

STEP 4. Replace the oxygen sensor (rear).

- After replacing the oxygen sensor (rear), re-check the trouble symptoms.

Q: Is the check result normal?
YES : Go to Step 5 .
NO : Check end.

STEP 5. Replace the catalytic converter.

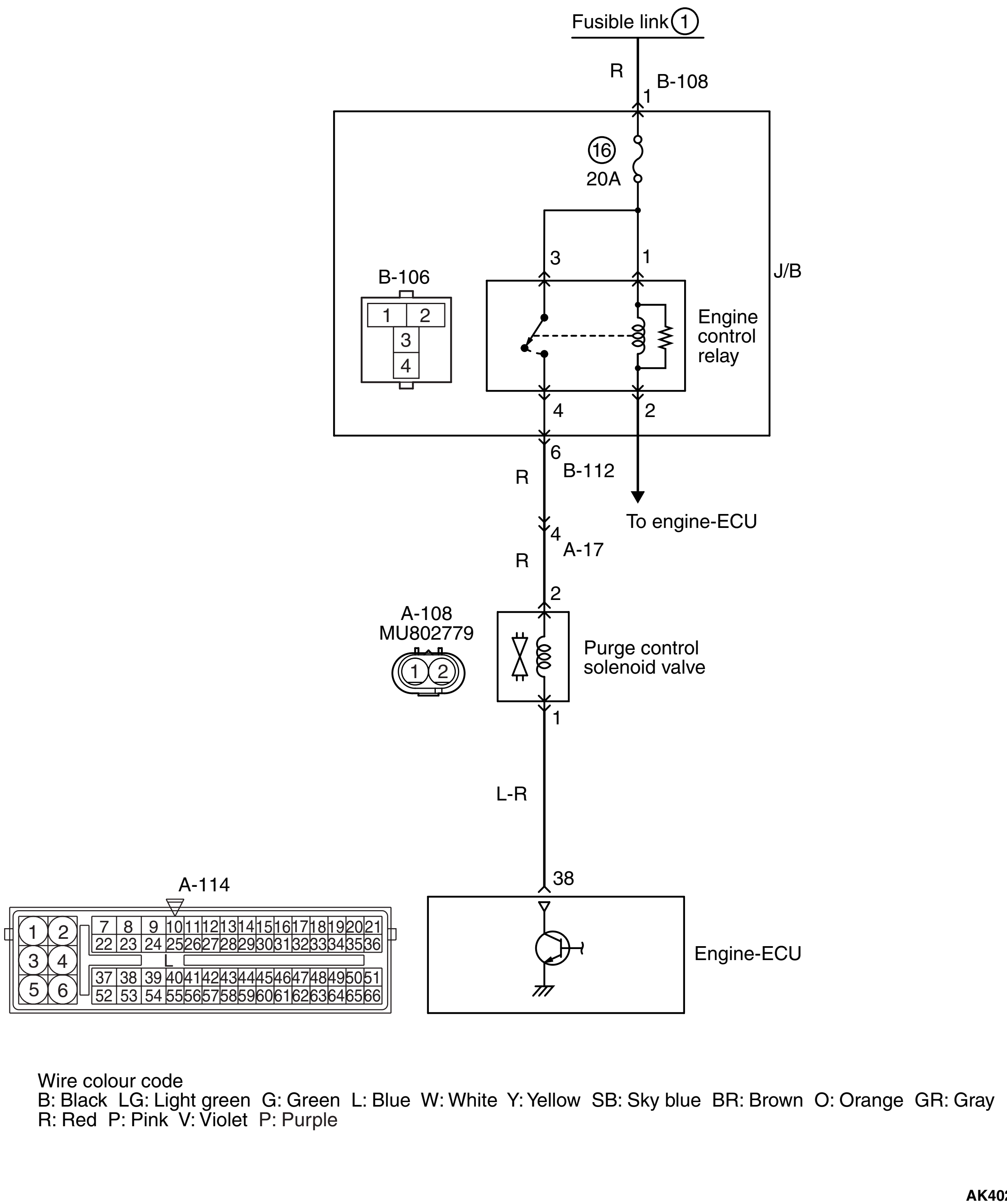
- After replacing the catalytic converter, re-check the trouble symptoms.

Q: Is the check result normal?
YES : Replacing engine-ECU.
NO : Check end.

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Code No. P0443: Purge Control Solenoid Valve System

Purge Control Solenoid Valve Circuit



OPERATION

- Power is supplied to the purge control solenoid valve (terminal No. 2) from the engine control relay (terminal No. 4).
- The engine-ECU (terminal No. 38) makes the power transistor in the unit be in ON position, and that makes currents go to the purge control solenoid valve (terminal No. 1).

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FUNCTION

- In response to a signal from the engine-ECU, the purge control solenoid valve controls the flow rate of the purge air to be introduced into the surge tank.

TROUBLE JUDGEMENT

Check Conditions

- While engine is being cranked
- Battery voltage is more than 10 V and is less than 16 V.

Judgement Criterion

- The surge voltage of solenoid coil is not detected when the purge control solenoid valve is turned in OFF position from ON.

PROBABLE CAUSES

- Failed purge control solenoid valve
- Open/short circuit in or damage to the purge control solenoid valve circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III actuator test

- Item 08: Purge control solenoid valve

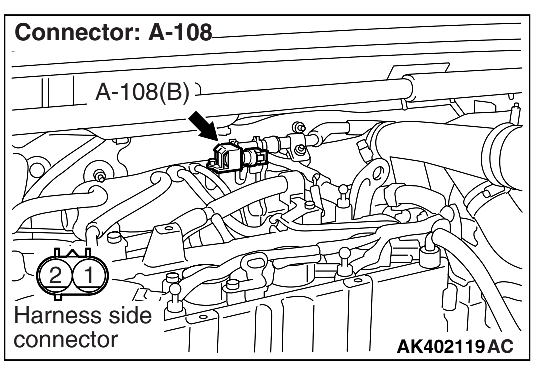
OK: Operating sound can be heard and the valve vibrates.

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

NO : Go to Step 2 .

STEP 2. Connector check: A-108 purge control solenoid valve connector

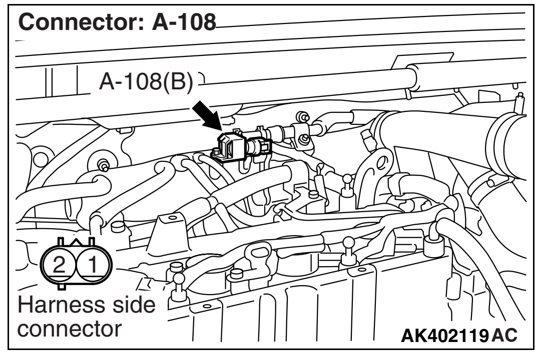


Q: Is the check result normal?

YES : Go to Step 3 .

NO : Repair or replace.

STEP 3. Perform resistance measurement at A-108 purge control solenoid valve connector.



- Disconnect connector, and measure at solenoid valve side.
- Resistance between terminals No. 1 and No. 2.

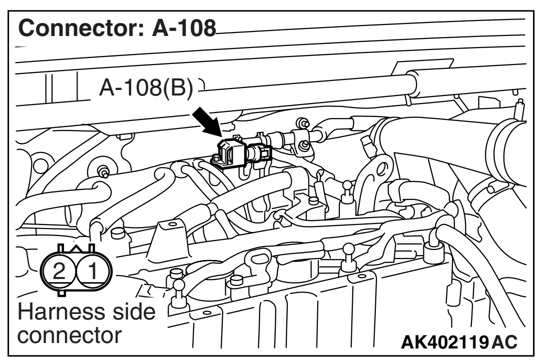
OK: 30 – 34 Ω (at 20°C)

Q: Is the check result normal?

YES : Go to Step 4 .

NO : Replace purge control solenoid valve.

STEP 4. Perform voltage measurement at A-108 purge control solenoid valve connector.



- Disconnect connector and measure at harness side.
- Ignition switch: ON
- Voltage between terminal No. 2 and earth.

OK: System voltage

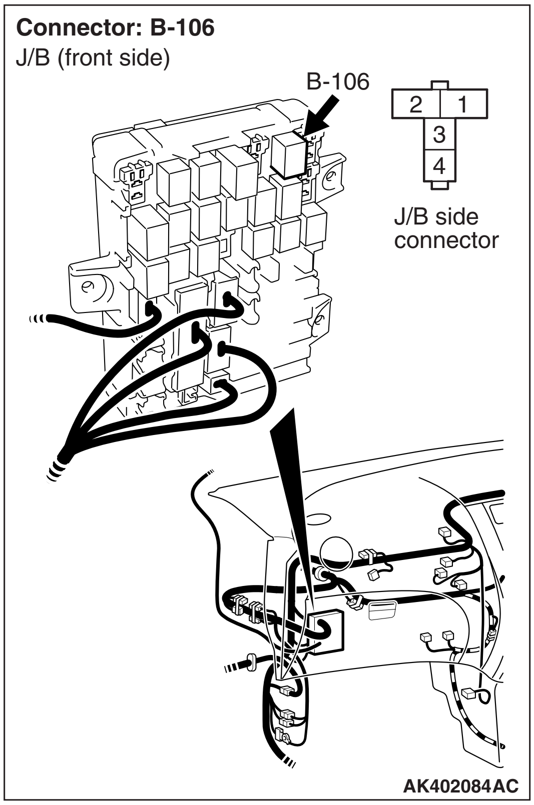
Q: Is the check result normal?

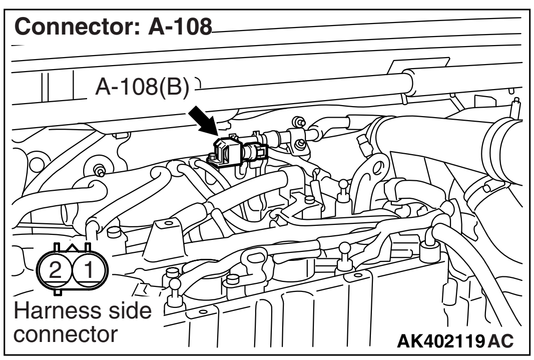
YES : Go to Step 6 .

NO : Go to Step 5 .

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STEP 5. Connector check: B-106 engine control relay connector





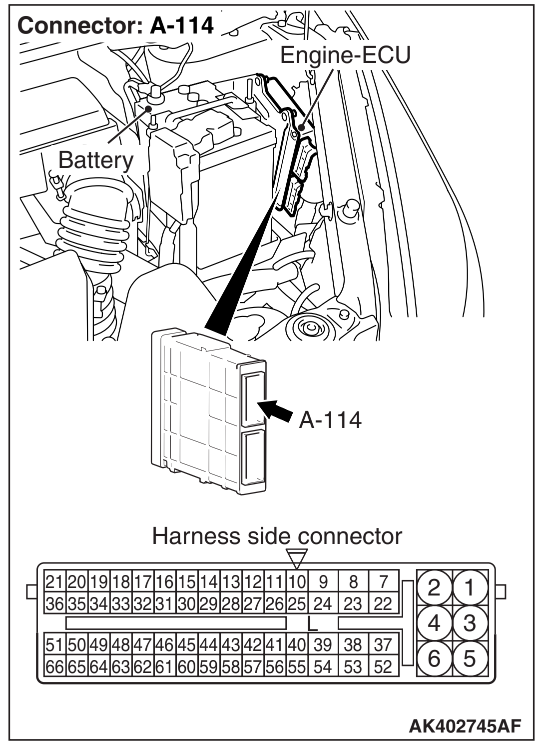
Q: Is the check result normal?

YES : Check intermediate connectors A-17 and B-112, and repair if necessary. If intermediate connectors are normal, check and repair harness between A-108 (terminal No. 2) purge control solenoid valve connector and B-106 (terminal No. 4) engine control relay connector.

- Check power supply line for open/short circuit.

NO : Repair or replace.

STEP 6. Perform voltage measurement at A-114 engine-ECU connector.



- Disconnect connector and measure at harness side.
- Ignition switch: ON
- Voltage between terminal No. 38 and earth.

OK: System voltage

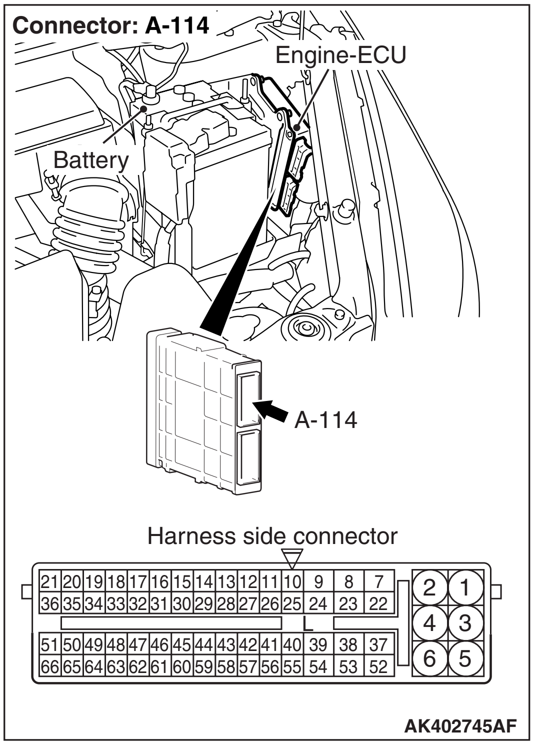
Q: Is the check result normal?

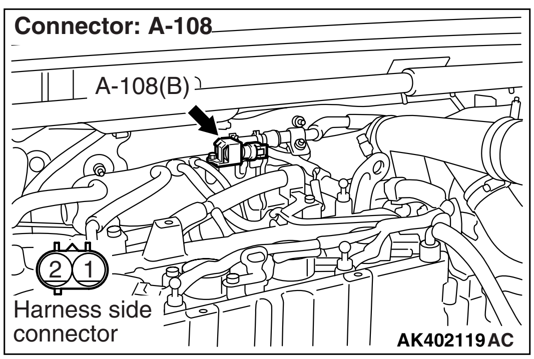
YES : Go to Step 8 .

NO : Go to Step 7 .

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STEP 7. Connector check: A-114 engine-ECU connector





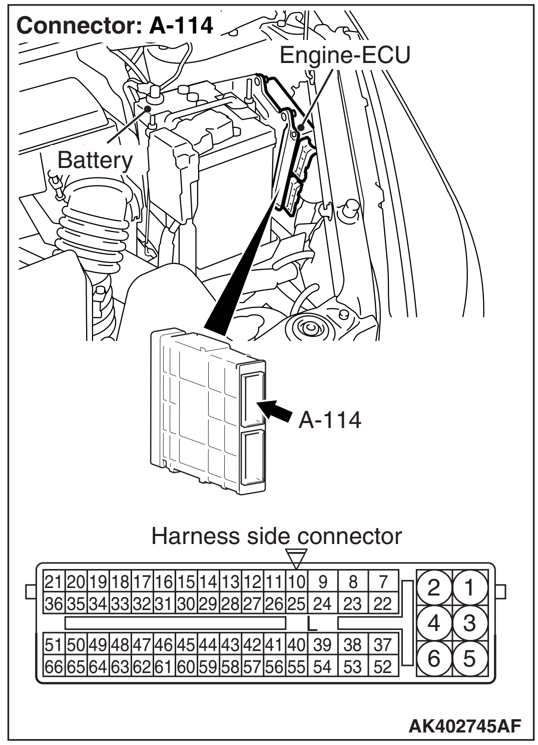
Q: Is the check result normal?

YES : Check and repair harness between A-108 (terminal No. 1) purge control solenoid valve connector and A-114 (terminal No. 38) engine-ECU connector.

- Check output line for open/short circuit.

NO : Repair or replace.

STEP 8. Connector check: A-114 engine-ECU connector

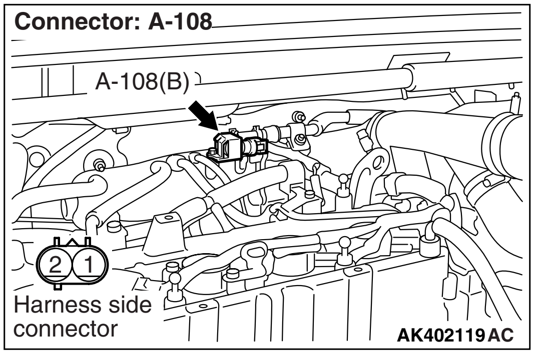


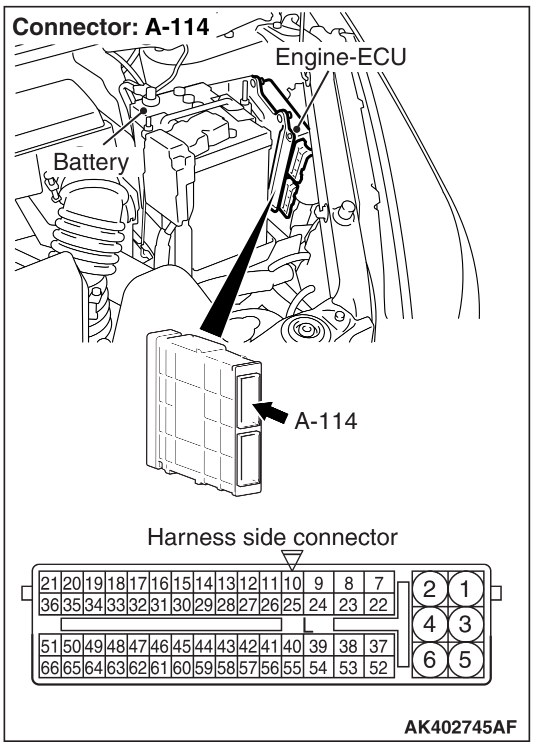
Q: Is the check result normal?

YES : Go to Step 9 .

NO : Repair or replace.

STEP 9. Check harness between A-108 (terminal No. 1) purge control solenoid valve connector and A-114 (terminal No. 38) engine-ECU connector.

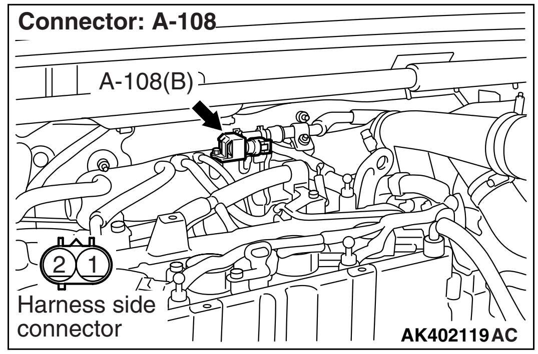


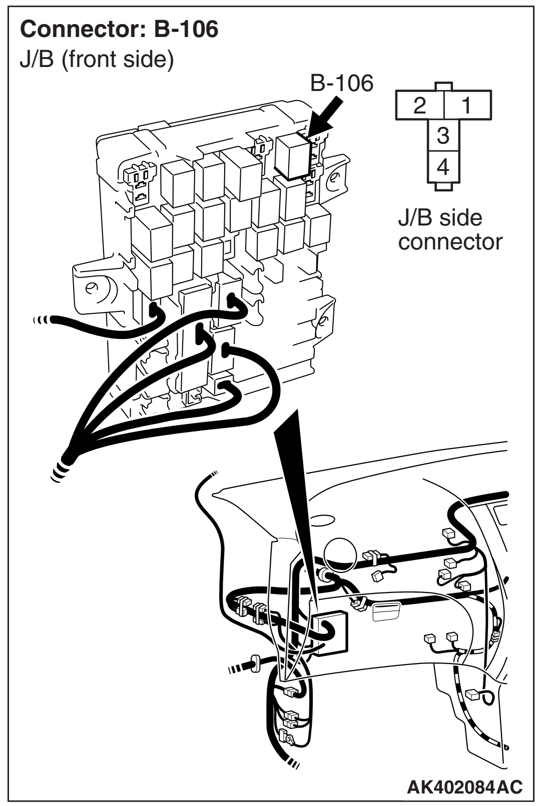


- Check output line for damage.

Q: Is the check result normal?
YES : Go to Step 10 .
NO : Repair.

STEP 10. Check harness between A-108 (terminal No. 2) purge control solenoid valve connector and B-106 (terminal No. 4) engine control relay connector.





NOTE: Before checking harness, check intermediate connectors A-17 and B-112, and repair if necessary.

- Check power supply line for damage.

Q: Is the check result normal?
YES : Go to Step 11 .
NO : Repair.

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STEP 11. M.U.T.-III actuator test

- Item 08: Purge control solenoid valve

OK: Operating sound can be heard and the valve vibrates.

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

NO : Replace engine-ECU.

Code No. P0500: Vehicle Speed Signal System

FUNCTION

- The vehicle speed signal is input to engine-ECU from ASC-ECU through CAN communication.

TROUBLE JUDGMENT

Check Condition

- 2 seconds later from when ignition switch is in ON position or after engine starts.

Judgement Criterion

- Engine speed is more than 2,500 r/min and is less than 4,500 r/min.
- Under the high load operation
- For 4 seconds, vehicle speed information received by CAN doesn't change.

Or

- For 4 seconds, vehicle speed information received by CAN is abnormal.

PROBABLE CAUSES

- Failed ABS-ECU <Vehicle without ASC>
- Failed ABS/ASC-ECU <Vehicle with ASC>
- Failed CAN
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

Q: Is diagnosis code related with CAN communication displayed?

YES : Inspection chart for diagnosis code (Refer to P.13B-18).

NO : Go to Step 2 .

STEP 2. M.U.T.-III other system diagnosis code

- Confirm whether the diagnosis codes are output from ASC-ECU.

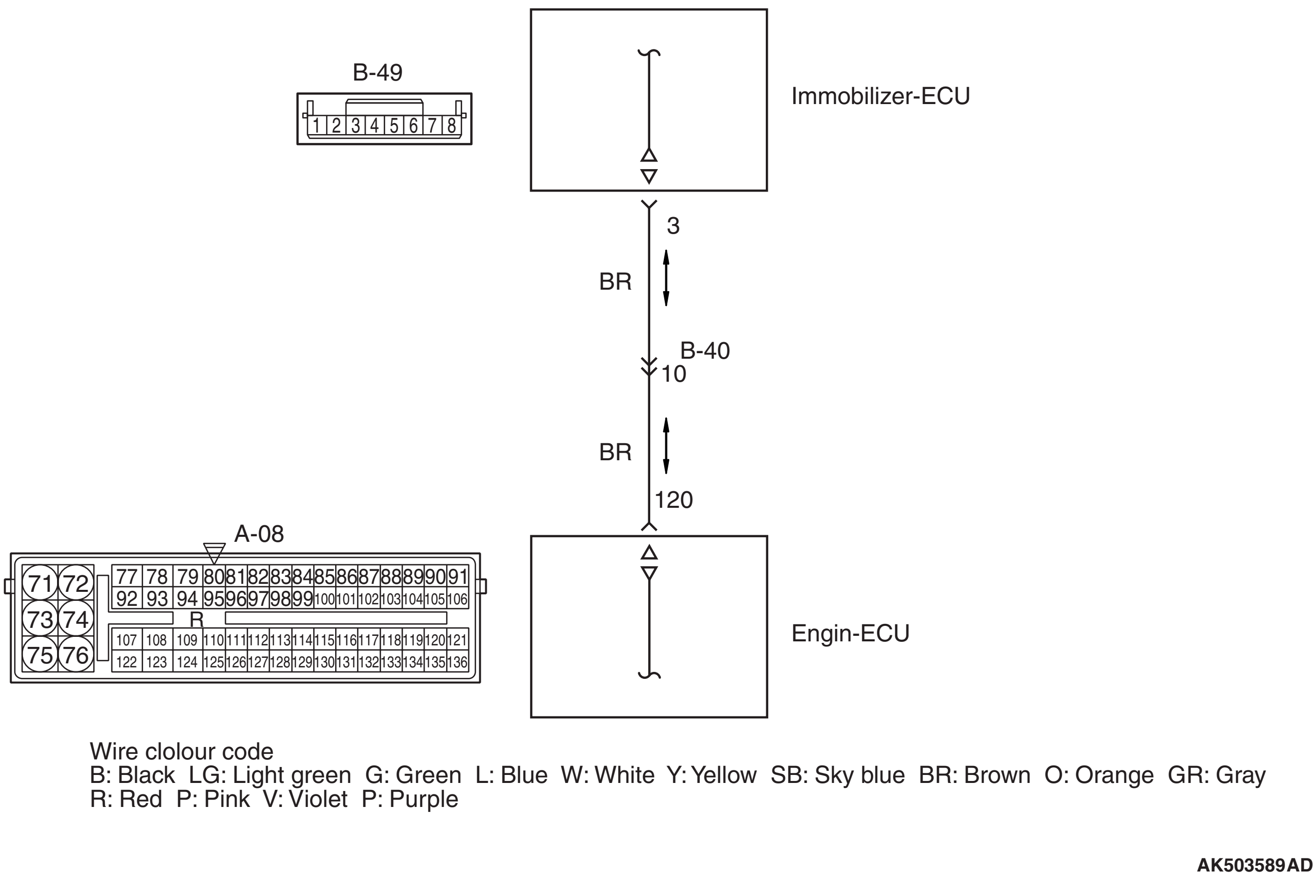
Q: Is the diagnosis code output?

YES : Perform the troubleshooting of ASC, (Refer to GROUP 35C – Troubleshooting – Diagnosis Code Chart P.35C-6).

NO : Replace engine-ECU.

Code No. P0513: Immobilizer Malfunction

Immobilizer-ECU Circuit



OPERATION

- The signals are sent and received between engine-ECU (terminal No. 120) and immobilizer-ECU (terminal No. 3).

FUNCTION

- Engine-ECU sends or receives the control signals to or from immobilizer-ECU to certify the ignition key.

NOTE:

- *If the registered ignition keys are close each other when starting the engine, radio interference may cause this code to be displayed.*
- *This code may be displayed when registering the key encrypted code.*

TROUBLE JUDGMENT

Check Condition

- Ignition switch is in "ON" position.

Judgment Criterion

- When the communication error between engine-ECU and the immobilizer-ECU continues for 4 seconds or more.

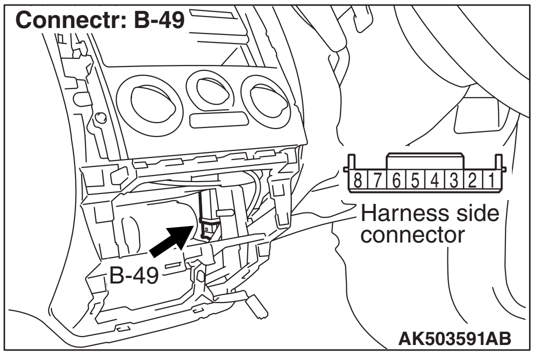
PROBABLE CAUSES

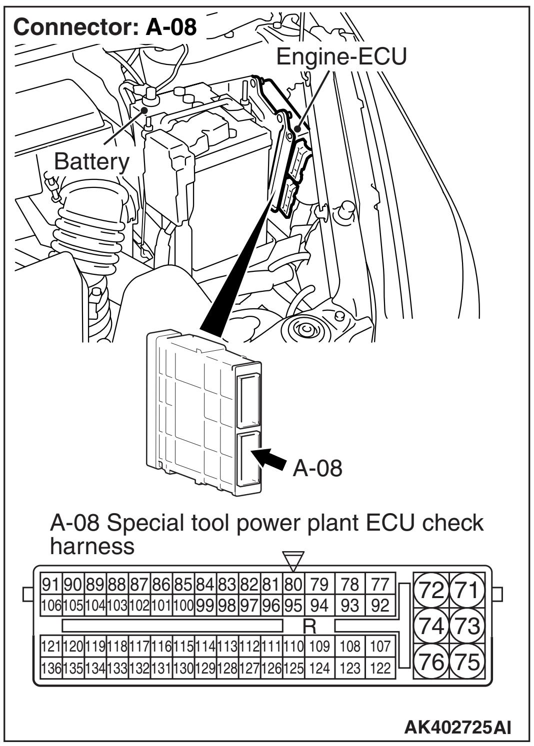
- Open/short circuit in immobilizer system circuit or loose connector contact
- Failed immobilizer-ECU
- Failed engine-ECU

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DIAGNOSIS PROCEDURE

STEP 1. Connector check: B-49 immobilizer-ECU connector and A-08 engine-ECU connector.



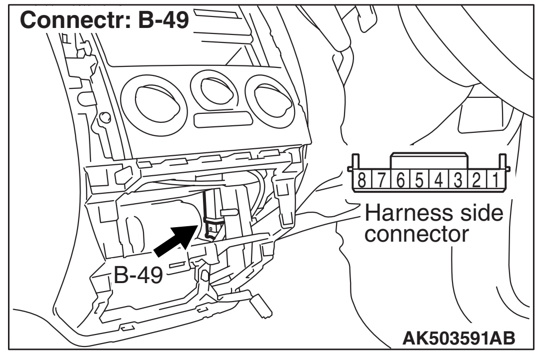


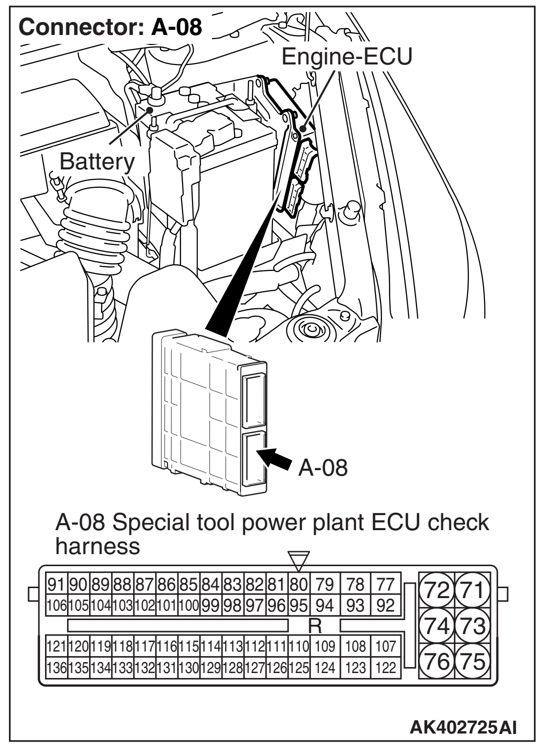
Q: Is the check result normal?

YES : Go to Step 2 .

NO : Repair or replace.

STEP 2. Check harness between B-49 (terminal No. 3) immobilizer-ECU connector and A-08 (terminal No. 120) engine-ECU connector.





NOTE: Before checking harness, check intermediate connector B-40, and repair if necessary.

- Check output line for open/short circuit and damage.

Q: Is the check result normal?

YES : Go to Step 3 .

NO : Repair.

STEP 3. Check the trouble symptoms.

Q: Is the check result normal?

YES : Go to Step 4 .

NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

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STEP 4. After replacing the immobilizer-ECU, re-check the trouble symptoms.

Q: Is the check result normal?

YES : Replace engine-ECU.
NO : Check end.

Code No. P0603: EEPROM Malfunction

FUNCTION

- The engine-ECU checks whether idling compensation value and other relevant data are stored in memory.

TROUBLE JUDGEMENT

Check Condition

- Ignition switch: ON

Judgement Criterion

- Last learning-date switch were written when ignition switch was in OFF is not stored correctly.

PROBABLE CAUSE

- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Q: Is the diagnosis code output?

YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

Code No. P0606: Microcomputer Malfunction System

FUNCTION

- The engine-ECU checks whether there is any abnormality in the microcomputer that controls the throttle valve operation.

TROUBLE JUDGEMENT

Check Condition

- Ignition switch is in "ON" position.
- Battery voltage is more than 6.3 V.

Judgement Criterion

- Main microcomputer reference voltage is abnomal.

PROBABLE CAUSE

- Failed engine-ECU

DIAGNOSIS PROCEDURE

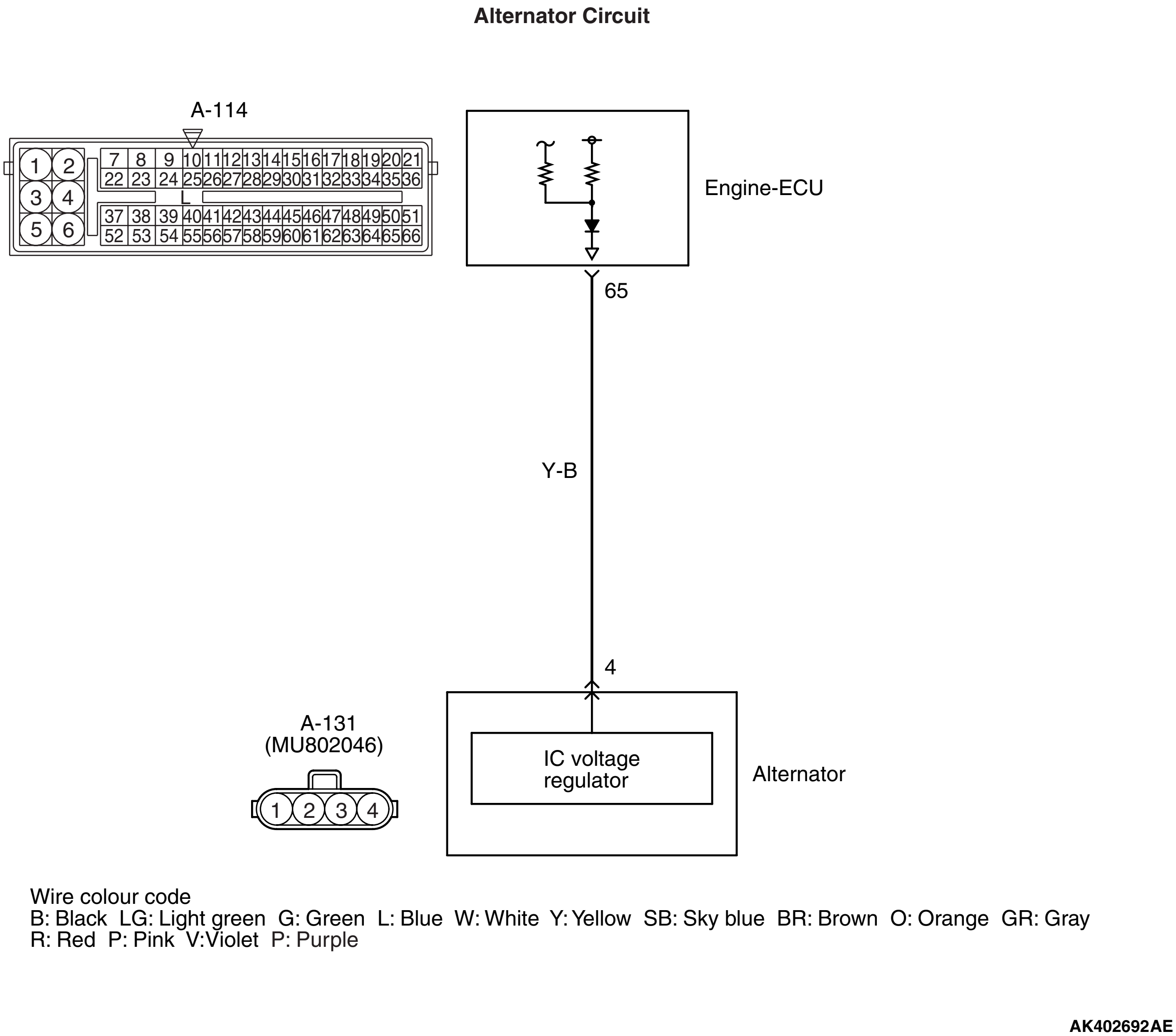
STEP 1. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Q: Is the diagnosis code output?

YES : Replace engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

Code No. P0622: Alternator FR Terminal System



OPERATION

- This system provides data on energized state of the field coil from the alternator (terminal No. 4) to the engine-ECU (terminal No. 65).

FUNCTION

- The system provides the engine-ECU with a signal that shows the energizing duty ratio of the alternator field coil.
- Using this signal, the engine-ECU determines the alternator output current (electric load), based on which the ECU controls the engine idling speed accordingly.

TROUBLE JUDGEMENT

Check Condition

- After engine starts.

Judgement Criterion

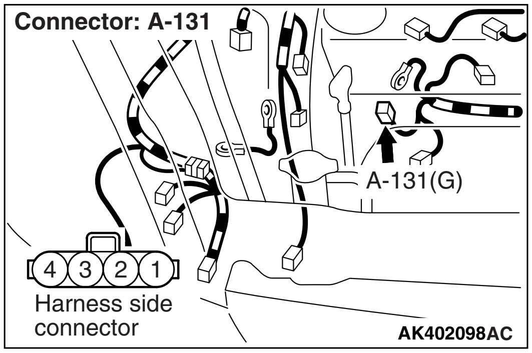
- Input voltage from the alternator FR terminal is battery voltage for 20 seconds.

PROBABLE CAUSES

- Failed alternator
- Short circuit in or damage to alternator circuit, or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

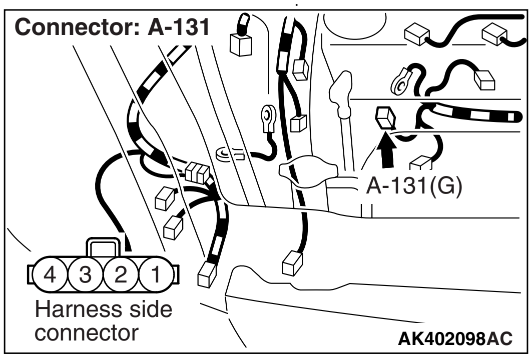
STEP 1. Connector check: A-131 alternator connector



Q: Is the check result normal?

YES : Go to Step 2.
NO : Repair or replace.

STEP 2. Perform voltage measurement at A-131 alternator connector.



Disconnect connector, and measure at harness side.

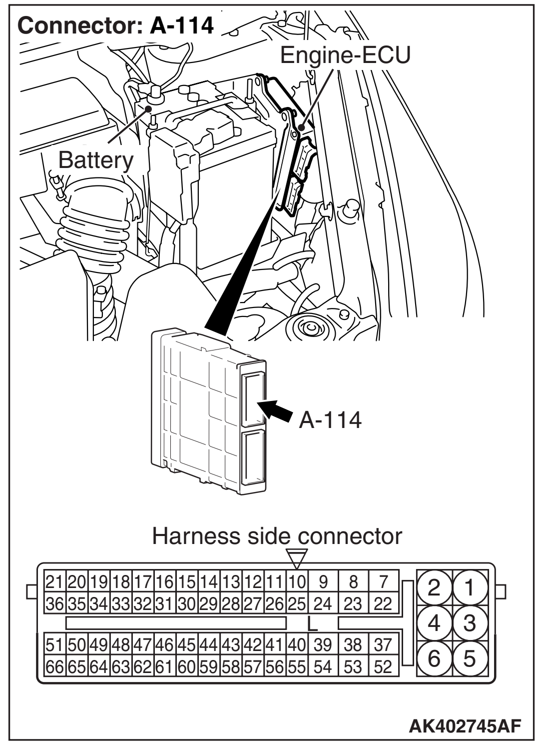
- Ignition switch: ON
- Voltage between terminal No. 4 and earth.

OK: System Voltage

Q: Is the check result normal?

YES : Go to Step 6.
NO : Go to Step 3.

STEP 3. Connector check: A-114 engine-ECU Connector

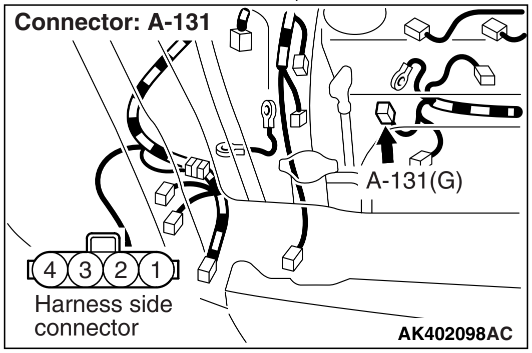


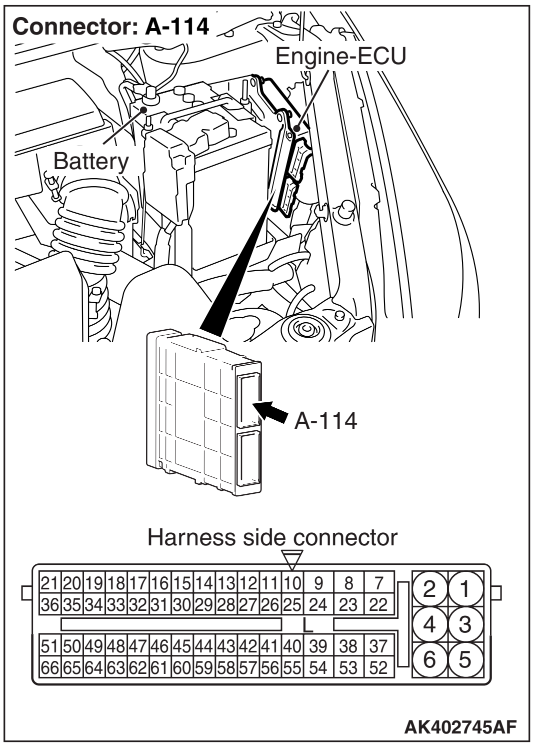
Q: Is the check result normal?

YES : Go to Step 4.
NO : Repair or replace.

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STEP 4. Check harness between A-131 (terminal No. 4) alternator connector and A-114 (terminal No. 65) engine-ECU connector.





Check the output line for open circuit.

Q: Is the check result normal?

YES : Go to Step 5.

NO : Repair.

STEP 5. M.U.T.-III diagnosis code

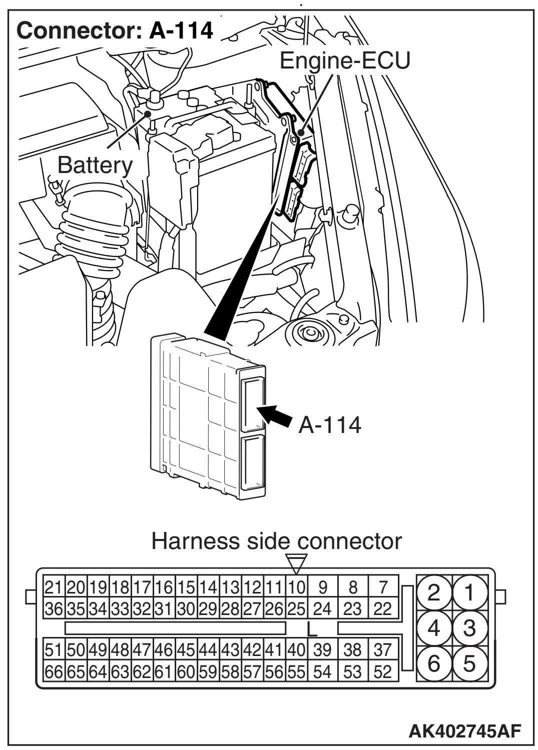
- Reconfirmation of diagnosis code.

Q: Is the diagnosis code output?

YES : Replace the engine-ECU.

NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

STEP 6. Perform voltage measurement at A-114 engine-ECU connector.



Disconnect engine-ECU connector, and connect special tool power plant ECU check harness (MB991987), and measure the voltage on the check connector.

- Engine: Idling after warm-up
- Transmission: Neutral
- Radiator fan: Inactive
- Voltage between terminal No. 65 and earth.

OK: Switching the headlamps from OFF to ON causes the voltage to drop.

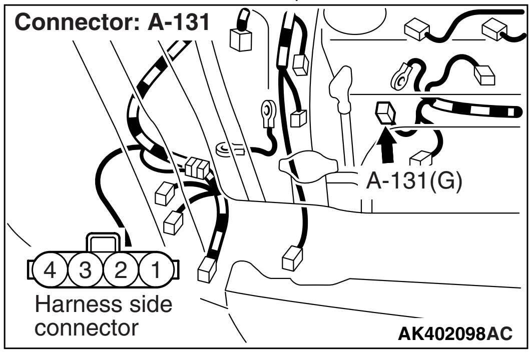
Q: Is the check result normal?

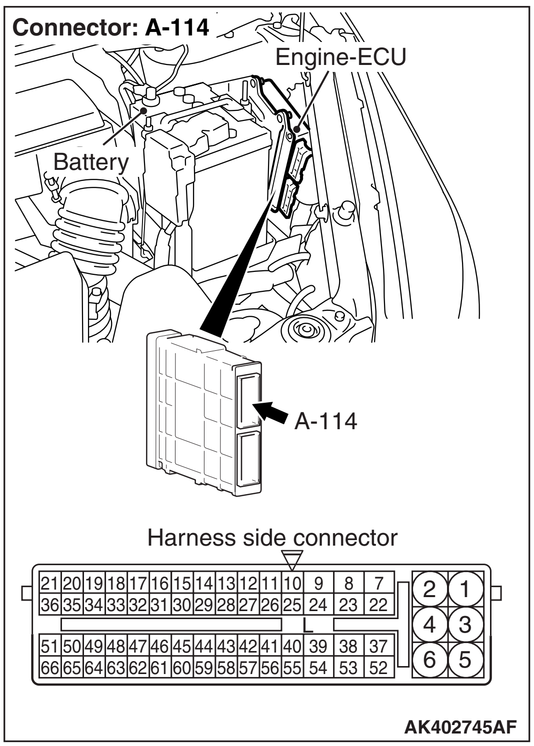
YES : Go to Step 7.

NO : Go to Step 9.

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STEP 7. Check harness between A-131 (terminal No. 4) alternator connector and A-114 (terminal No. 65) engine-ECU connector.





Check output line for damage.

Q: Is the check result normal?

YES : Go to Step 8.

NO : Repair.

STEP 8. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Q: Is the diagnosis code output?

YES : Replace the alternator.

NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

STEP 9. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

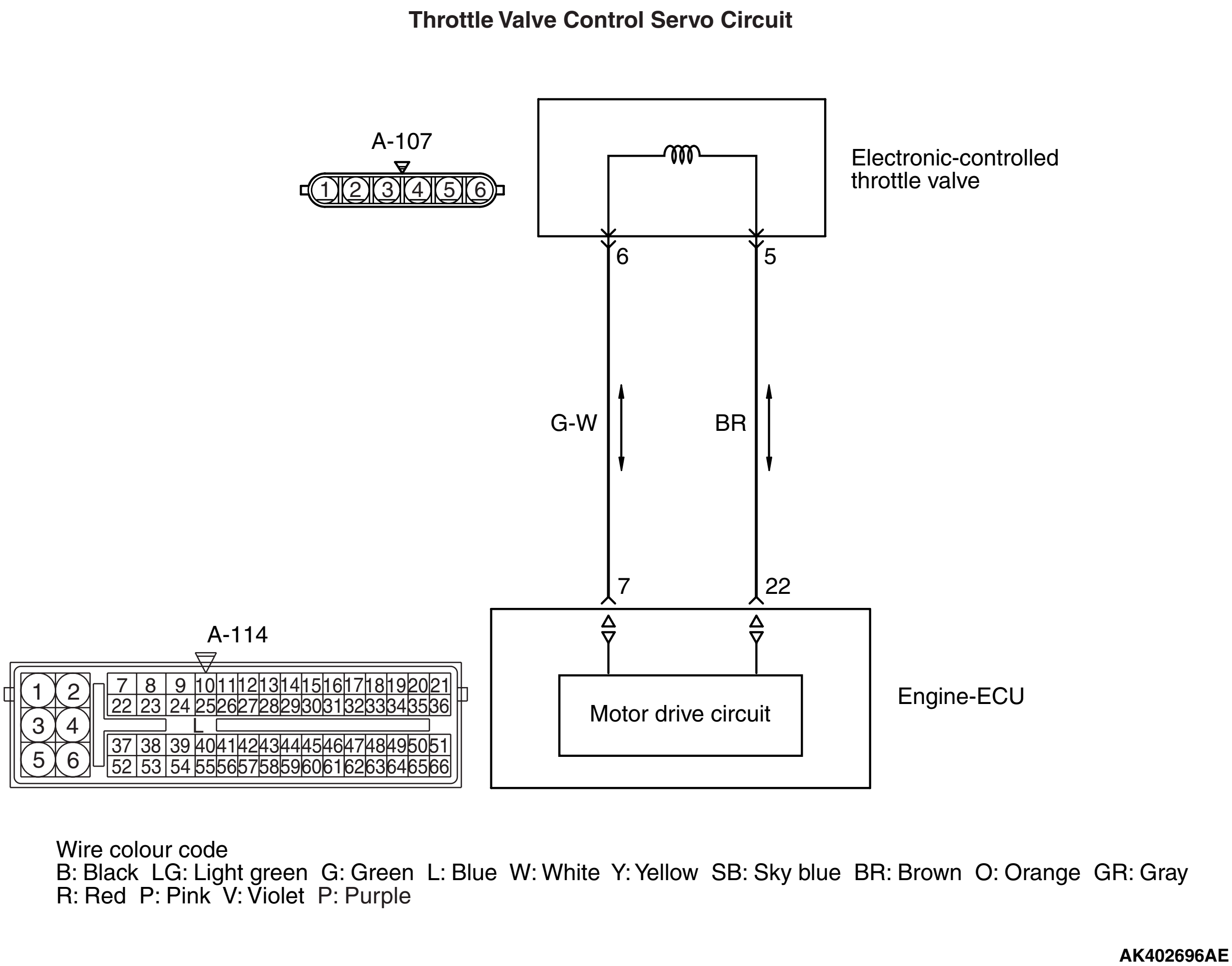
Q: Is the diagnosis code output?

YES : Replace the engine-ECU.

NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

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Code No. P0638: Throttle Valve Control Servo Circuit Range/Performance Problem



OPERATION

- This system controls the electric current from the engine-ECU (terminals No. 7 and No. 22) to the throttle valve control servo (terminals No. 5 and No. 6).

FUNCTION

- The engine-ECU controls the opening of the throttle valve by changing the direction and the amount of the current flowing to the servo coil.

TROUBLE JUDGEMENT

Check Conditions

- Ignition switch is in "ON" position.
- Battery voltage is more than 8.3 V.
- Throttle position sensor (main) output voltage is more than 0.2 V and is less than 4.8 V.
- When variation in throttle valve opening angle is small.

Judgement Criterion

- Difference is more than 0.5 V between actual output voltage and target output voltage of throttle position sensor (main).

Check Conditions

- Ignition switch is in "ON" position.
- (Main and sub) throttle position sensor are normal.

Judgement Criterion

- Learning value of throttle position sensor (main) middle opening angle is more than 4.0 V.

PROBABLE CAUSES

- Failed throttle valve return spring
- Failed throttle valve operation
- Failed throttle valve control servo
- Short circuit in or damage to the throttle valve control servo circuit, or loose connector contact
- Failed engine-ECU

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DIAGNOSIS PROCEDURE

STEP 1. Check throttle body.

- Check whether the throttle valve return spring is normal.

Q: Is the check result normal?

YES : Go to Step 2.
NO : Replace the throttle body assembly.

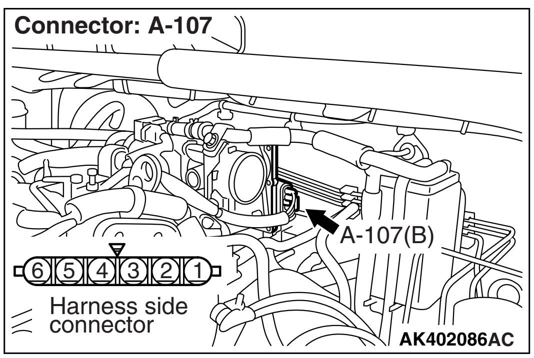
STEP 2. Check electronic-controlled throttle valve itself.

- Check electronic-controlled throttle valve (Refer to P.13B-368).

Q: Is the check result normal?

YES : Go to Step 3.
NO : Replace the throttle body assembly.

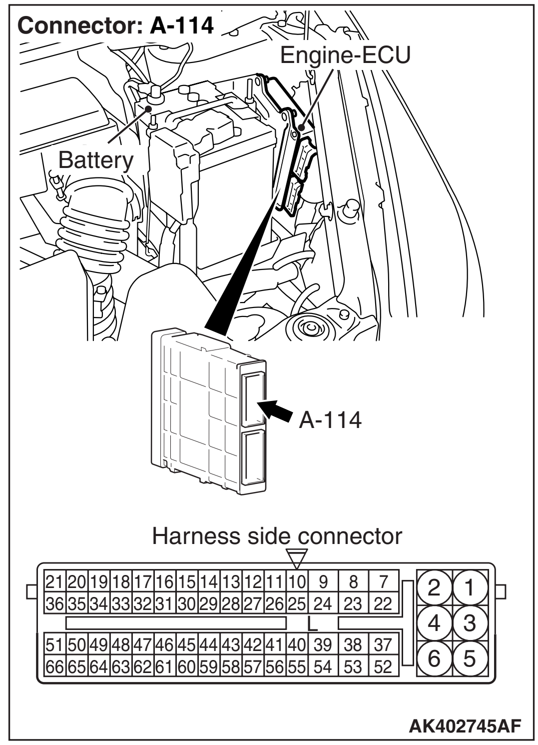
STEP 3. Connector check: A-107 electronic-controlled throttle valve connector



Q: Is the check result normal?

YES : Go to Step 4.
NO : Repair or replace.

STEP 4. Connector check: A-114 engine-ECU connector

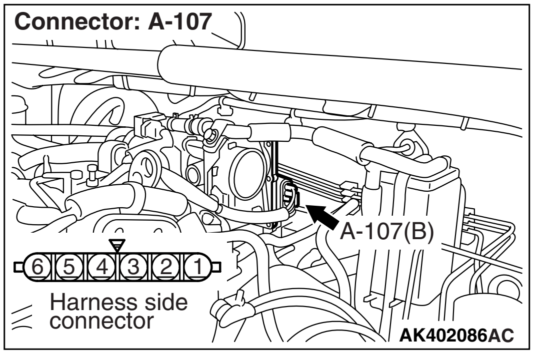


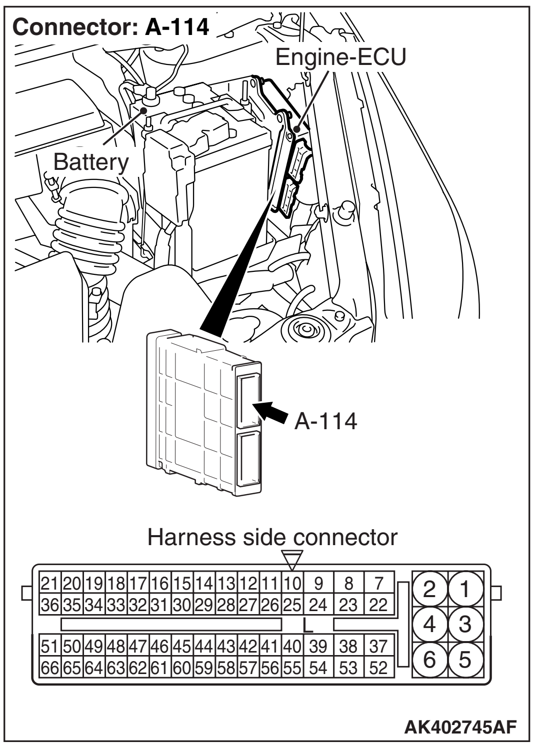
Q: Is the check result normal?

YES : Go to Step 5.
NO : Repair or replace.

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STEP 5. Check harness between A-107 (terminal No. 5) electronic-controlled throttle valve connector and A-114 (terminal No. 22) engine-ECU connector.

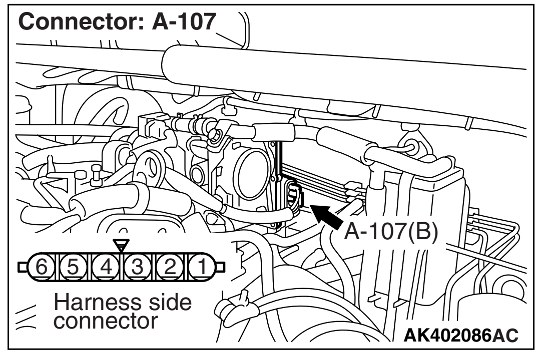


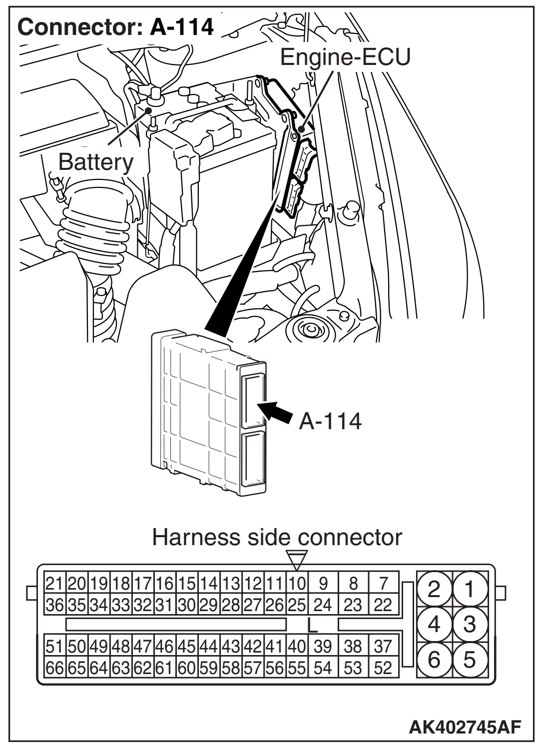


Check signal line for short circuit and damage.

Q: Is the check result normal?
YES : Go to Step 6.
NO : Repair.

STEP 6. Check harness between A-107 (terminal No. 6) electronic-controlled throttle valve connector and A-114 (terminal No. 7) engine-ECU connector.





Check signal line for short circuit and damage.

Q: Is the check result normal?
YES : Go to Step 7.
NO : Repair.

STEP 7. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Q: Is the diagnosis code output?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

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Code No. P0642: Throttle Position Sensor Power Supply

FUNCTION

- Engine-ECU checks the throttle position sensor power voltage for abnormal conditions.

TROUBLE JUDGMENT

Check Conditions

- Ignition switch is in "ON" position.
- Battery positive voltage is more than 6.3 V.

Judgement Criteria

- Throttle position sensor power voltage is less than 4.1 V.

PROBALE CAUSE

- Failed engine-ECU <M/T>

DIAGNOSIS

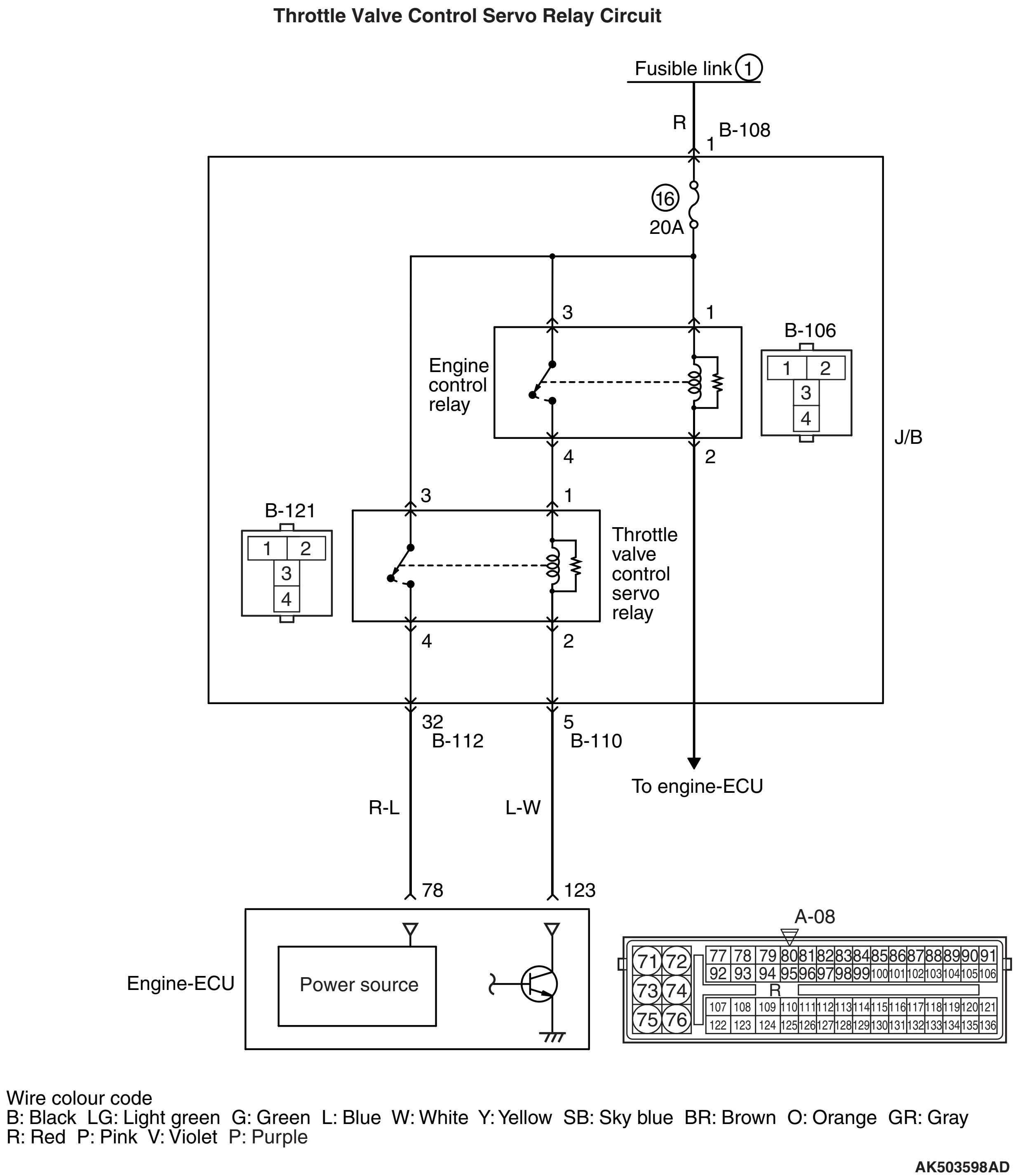
STEP 1. Check the trouble symptoms.

Q: Does trouble symptom persist?

YES : Replace engine-ECU.

NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

Code No. P0657: Throttle Valve Control Servo Relay Circuit Malfunction



OPERATION

- Battery voltage is applied to the throttle valve control servo relay terminal (terminal No. 3).
- Battery voltage is applied to the throttle valve control servo relay terminal (terminal No. 1) from the engine control relay (terminal No. 4).
- Engine-ECU (terminal No. 123) applies current to the throttle valve control servo relay coil by turning ON the power transistor in the unit in order to turn the relay ON.
- When the throttle valve control servo relay turns ON, battery voltage is supplied by the throttle valve control servo relay (terminal No. 4) to the engine-ECU (terminal No. 78).

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FUNCTION

- When the ignition switch ON signal is input into the engine-ECU, the engine-ECU turns ON the throttle valve control servo.

TROUBLE JUDGMENT

Check Condition

- After engine starts

Judgement Criterions

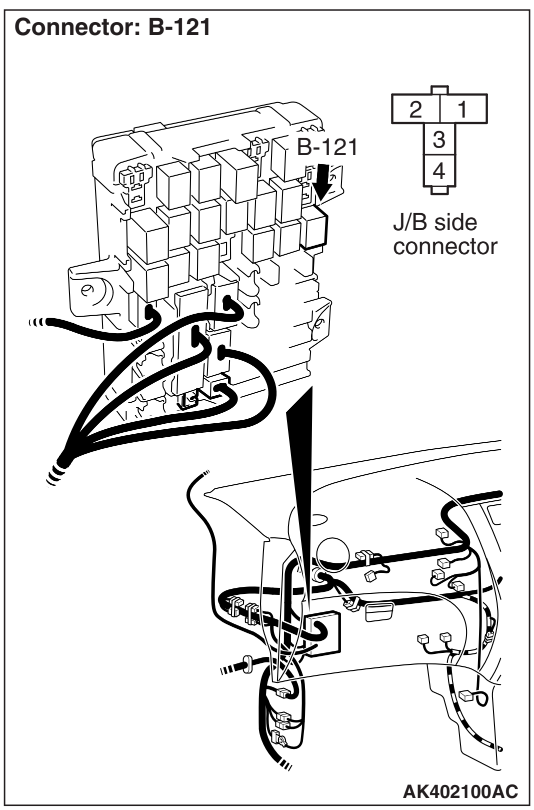
- Throttle valve control servo supply voltage is less than 6.0 V.
- Battery voltage is more than 8.3 V.

PROBALE CAUSES

- Failed throttle valve return spring
- Open/short circuit and damage in throttle valve control servo circuit or loose connector contact.
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Connector check: B-121 throttle valve control servo relay connector



Q: Is the check result normal?

YES : Go to Step 2 .

NO : Repair or replace the connector.

STEP 2. Check throttle valve control servo relay itself.

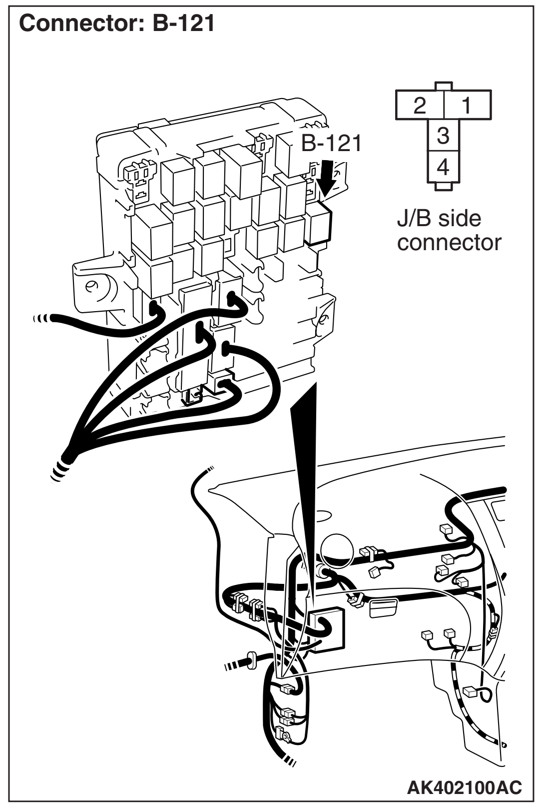
- Check throttle valve control servo relay (Refer to P.13B-364).

Q: Is the check result normal?

YES : Go to Step 3 .

NO : Replace the throttle valve control servo relay.

STEP 3. Perform voltage measurement at B-121 throttle valve control servo relay connector.



- Remove relay, and measure at J/B side.
- Voltage between terminal No. 3 and earth.

OK: System voltage

Q: Is the check result normal?

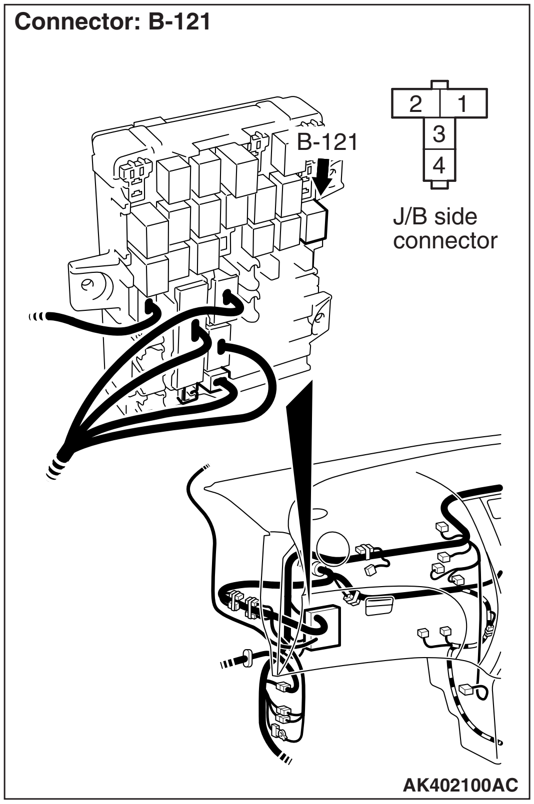
YES : Go to Step 4 .

NO : Check intermediate connector B-208, and repair if necessary. If intermediate connector is normal, Check and repair harness between B-121 (terminal No. 3) throttle valve control servo relay connector and battery.

- Check power supply line for open/short circuit.

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STEP 4. Perform voltage measurement at B-121 throttle valve control servo relay connector.



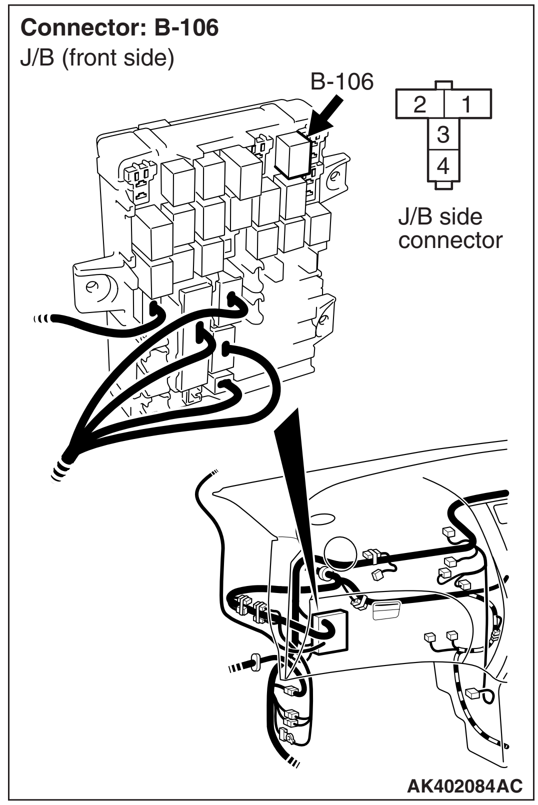
- Remove relay, and measure at J/B side.
- Ignition switch: ON
- Voltage between terminal No. 1 and earth.

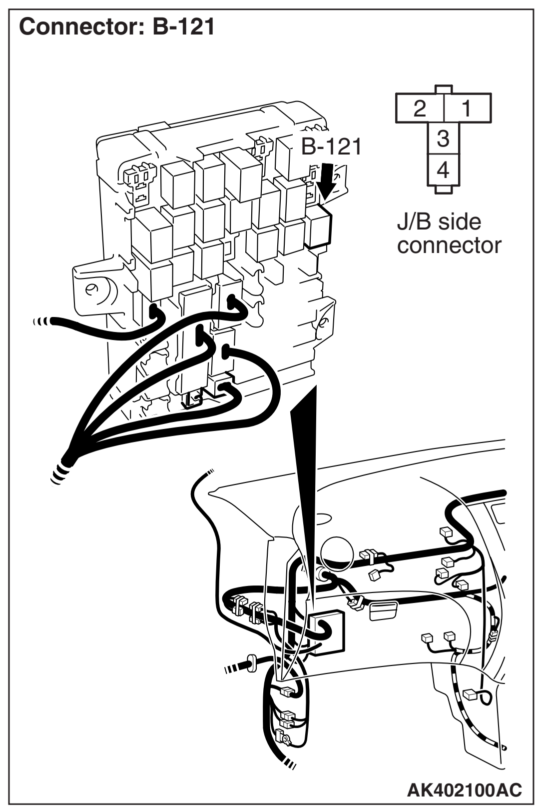
OK: System voltage

Q: Is the check result normal?

YES : Go to Step 6 .
NO : Go to Step 5 .

STEP 5. Connector check: B-106 engine control relay connector





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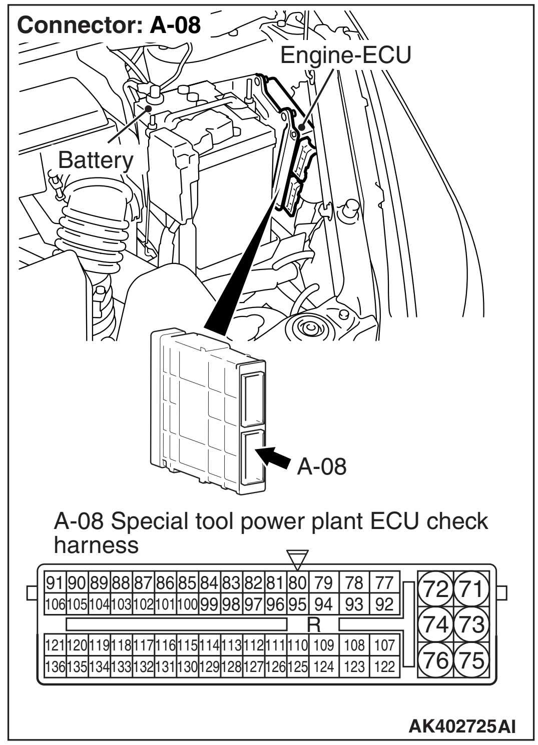
Q: Is the check result normal?

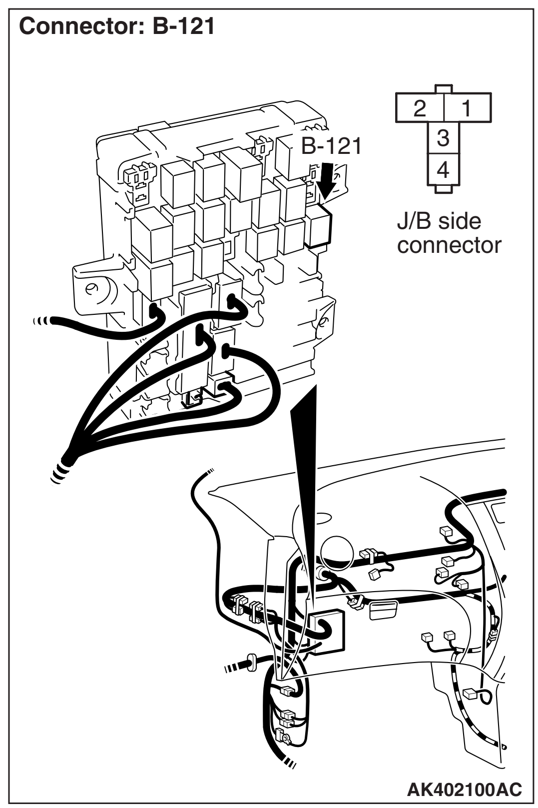
YES : Check and repair harness between B-106 (terminal No. 4) engine control relay connector and B-121 (terminal No. 1) throttle valve control servo relay connector.

- Check power supply line for open/short circuit.

NO : Repair or replace the connector.

STEP 6. Perform voltage measurement at A-08 engine-ECU connector.





- Disconnect connector, and measure at harness side.
- Ignition switch: ON
- Voltage between terminal No. 123 and earth.

OK: System voltage

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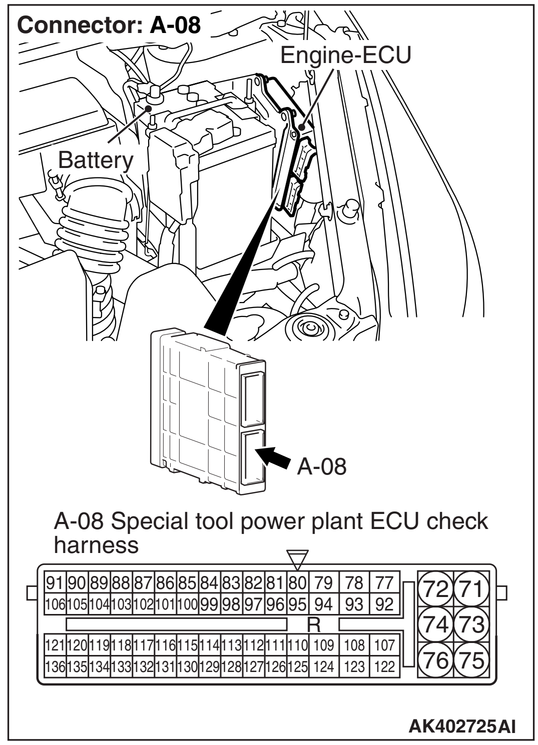
Q: Is the check result normal?

YES : Go to Step 7 .

NO : Check intermediate connector B-110, and repair if necessary. If intermediate connector is normal, check and repair harness between B-121 (terminal No. 2) throttle valve control servo relay connector and A-08 (terminal No. 123) engine-ECU connector.

- Check earthing line for open/short circuit.

STEP 7. Perform voltage measurement at A-08 engine-ECU connector.



- Disconnect connector, and measure at harness side.
- Ignition switch: ON
- Voltage between terminal No. 78 and earth.

OK: System voltage

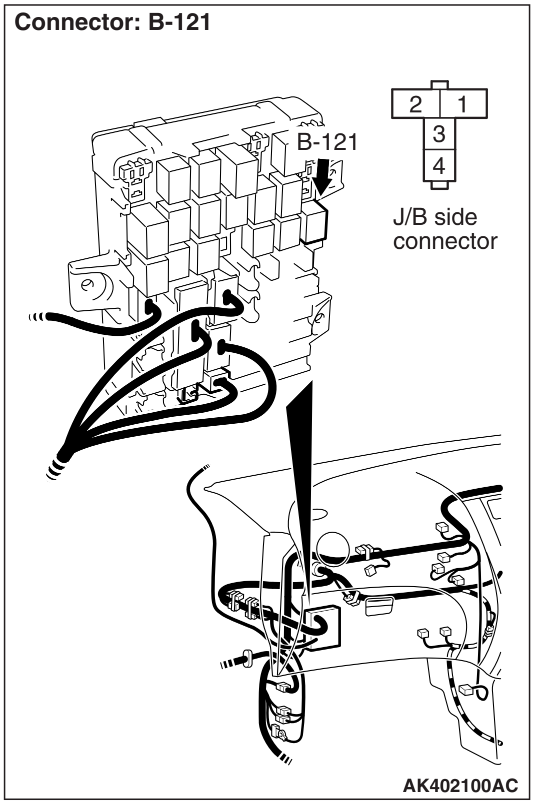
Q: Is the check result normal?

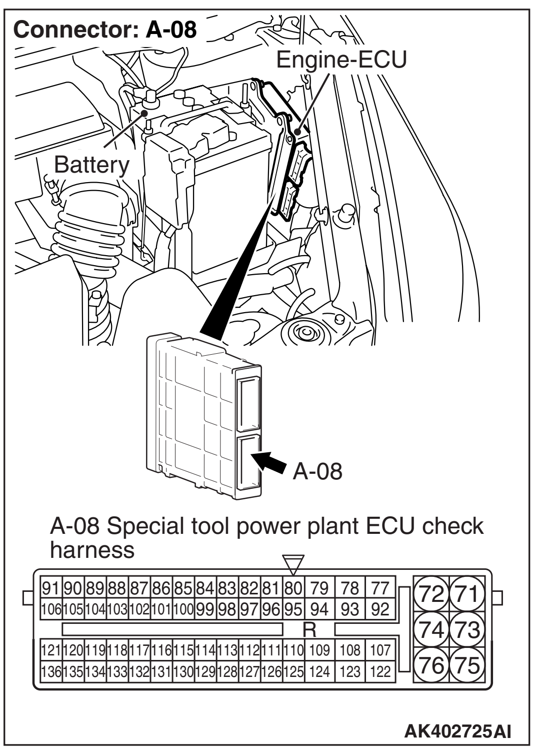
YES : Go to Step 10 .

NO : Go to Step 8 .

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STEP 8. Check harness between B-121 (terminal No. 4) throttle valve control servo relay connector and A-08 (terminal No. 78) engine-ECU connector.



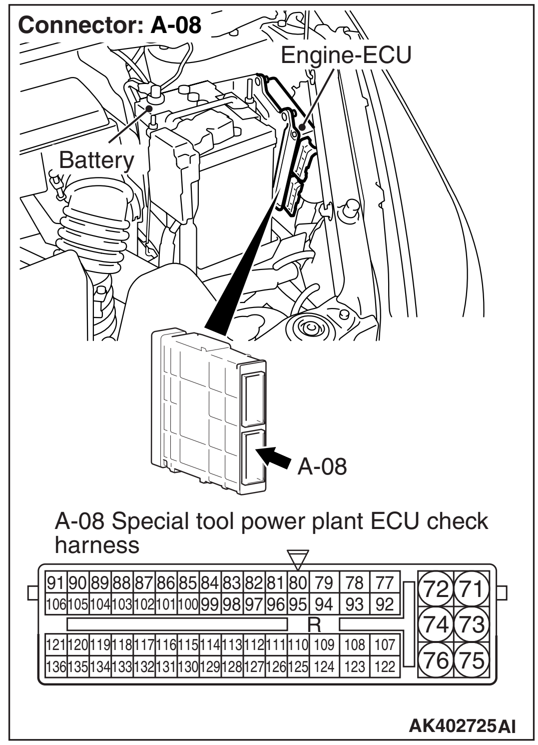


NOTE: Before checking harness, check intermediate connector B-112, and repair if necessary.

- Check power supply line for open/short circuit.

Q: Is the check result normal?
YES : Go to Step 9 .
NO : Repair the damaged harness wire.

STEP 9. Connector check: A-08 engine-ECU connector.

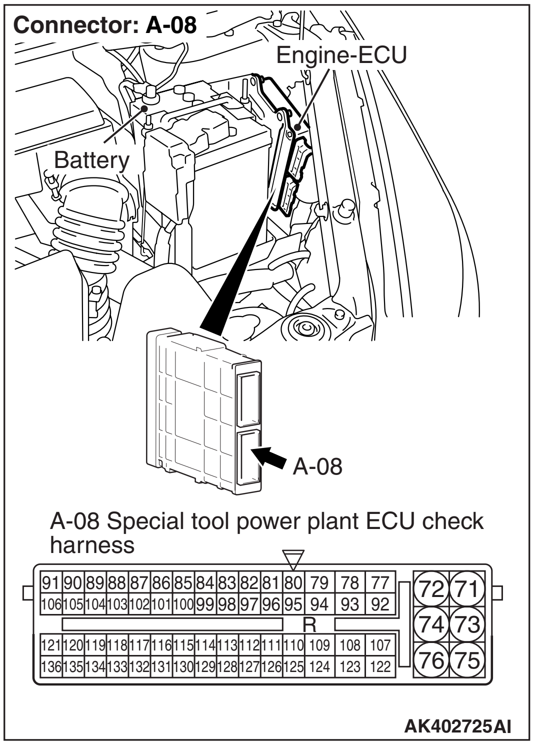


- Check output line for damage.

Q: Is the check result normal?
YES : Replace engine-ECU.
NO : Repair or replace the connector.

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STEP 10. Connector check: A-08 engine-ECU connector

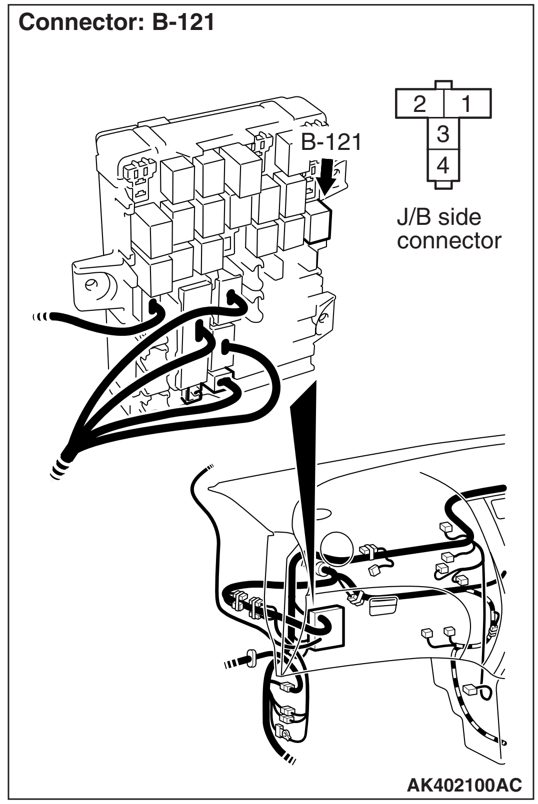


Q: Is the check result normal?

YES : Go to Step 11 .

NO : Repair or replace the connector.

STEP 11. Check and repair harness between B-121 (terminal No. 3) throttle valve control servo relay connector and battery.



NOTE: Before checking harness, check intermediate connector B-108, and repair if necessary.

- Check power supply line for damage.

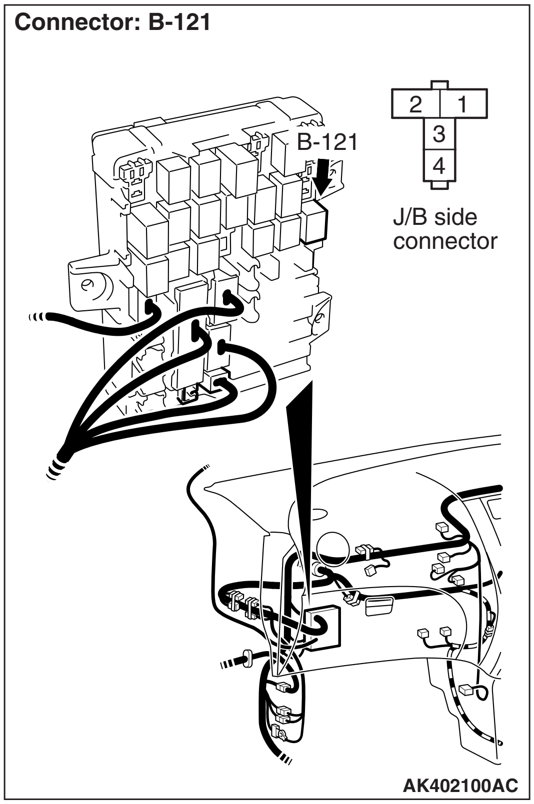
Q: Is the harness connector in good condition?

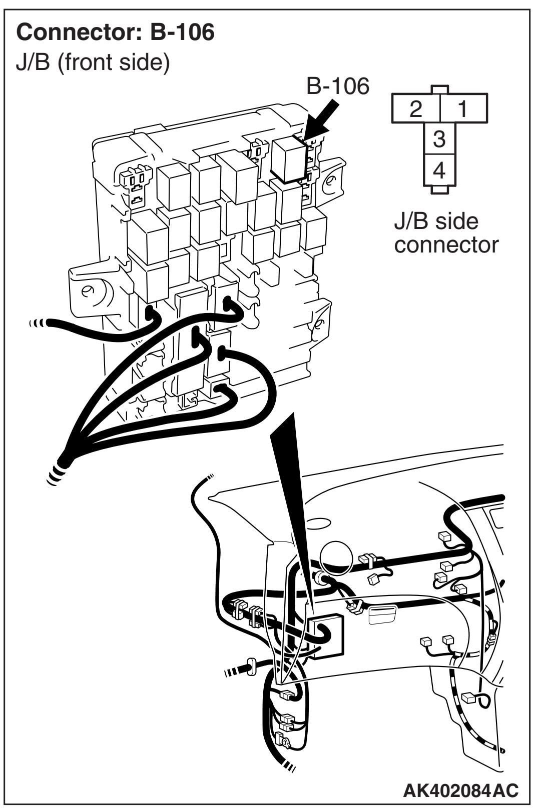
YES : Go to Step 12 .

NO : Repair the damaged harness wire.

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STEP 12. Check and repair harness between B-121 (terminal No. 1) throttle valve control servo relay connector and B-106 (terminal No. 4) engine control relay connector.





- Check power supply line for damage.

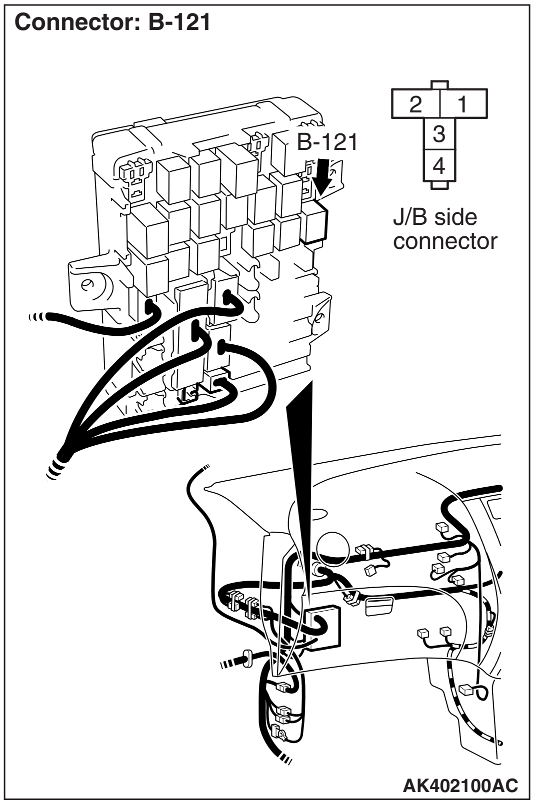
Q: Is the harness connector in good condition?

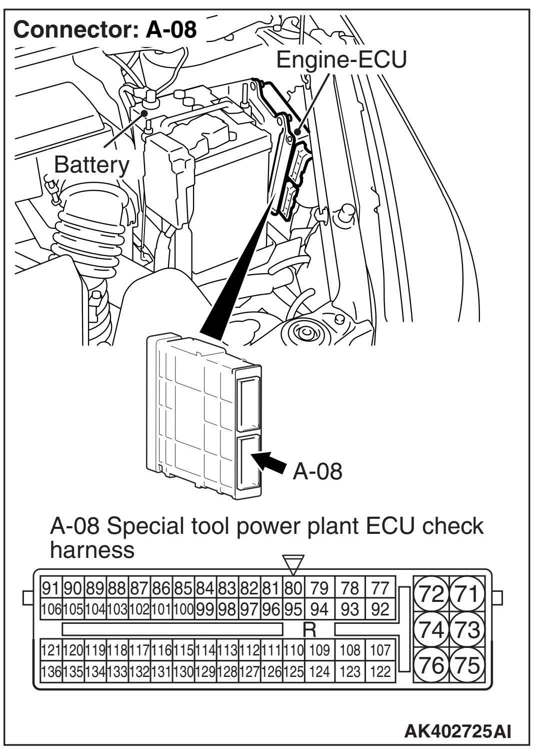
YES : Go to Step 13 .

NO : Repair the damaged harness wire.

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STEP 13. Check and repair harness between B-121 (terminal No. 2) throttle valve control servo relay connector and A-08 (terminal No. 123) engine-ECU connector.





NOTE: Before checking harness, check intermediate connector B-110, and repair if necessary.

- Check power supply line for damage.

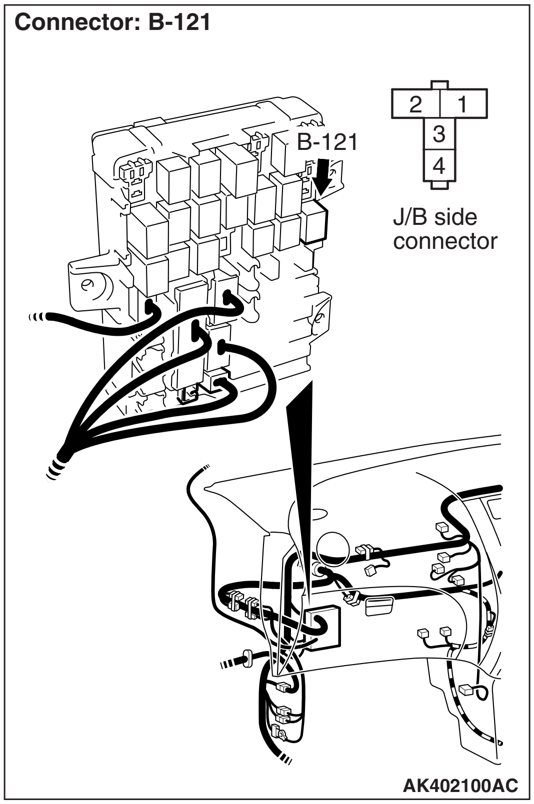
Q: Is the harness connector in good condition?

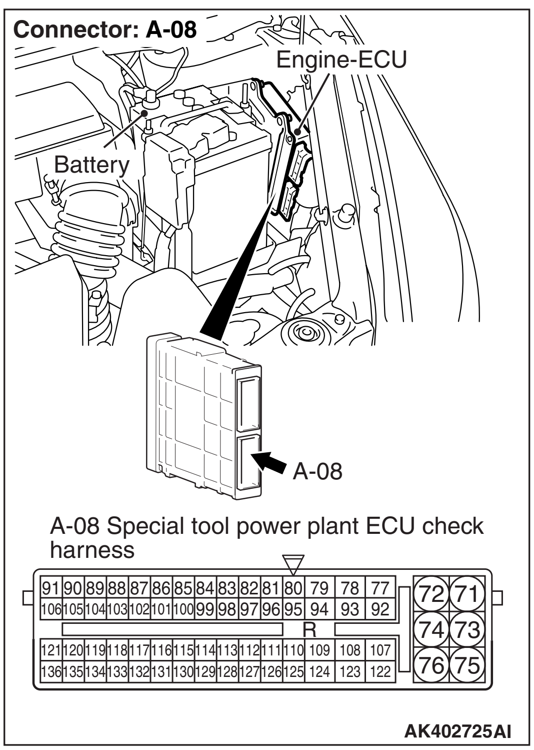
YES : Go to Step 14 .

NO : Repair the damaged harness wire.

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STEP 14. Check and repair harness between B-121 (terminal No. 4) throttle valve control servo relay connector and A-08 (terminal No. 78) engine-ECU connector.





NOTE: Before checking harness, check intermediate connector B-112, and repair if necessary.

- Check power supply line for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 15 .

NO : Repair the damaged harness wire.

STEP 15. M.U.T.-III diagnosis code.

- Reconfirmation of diagnosis code.

Q: Is the diagnosis code set?

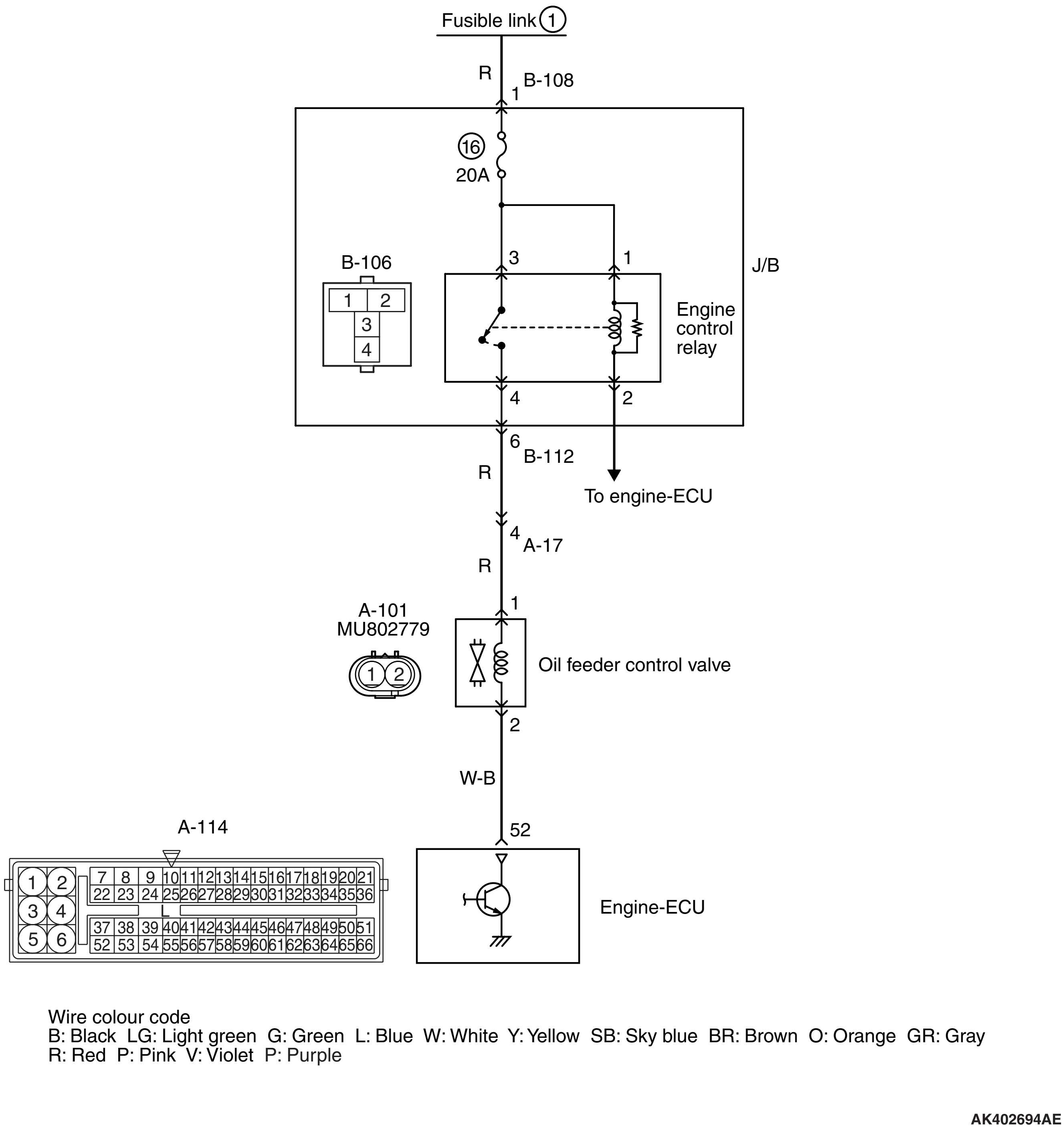
YES : Replace engine-ECU.

NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

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Code No. P1021: Oil Feeder Control Valve System

Oil Feeder Control Valve Circuit



OPERATION

- Power is supplied to the oil feeder control valve (terminal No. 1) from the battery.
- The engine-ECU (terminal No. 52) energizes the oil feeder control valve (terminal No. 2) by turning on the power transistor in the unit

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FUNCTION

- The oil feeder control valve controls the phase angle of the intake camshaft by the signal from the engine-ECU.

TROUBLE JUDGEMENT

Check Conditions

- Ignition switch is in "ON" position.
- Oil feeder control valve is in OFF position.

Judgement Criterion

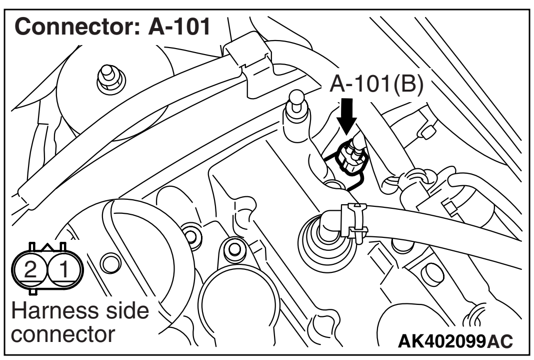
- For 4 seconds, driving voltage of oil feeder control valve in engine ECU is abnormal.

PROBABLE CAUSES

- Failed oil feeder control valve
- Open/short circuit in or damage to the oil feeder control valve circuit, or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Connector check: A-101 oil feeder control valve connector



Q: Is the check result normal?

YES : Go to Step 2.

NO : Repair or replace.

STEP 2. Check oil feeder control valve.

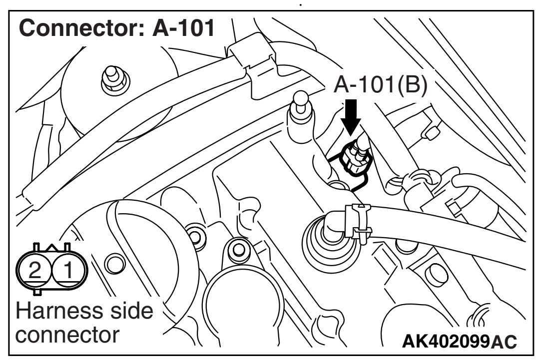
- Check oil feeder control valve (Refer to P.13B-369).

Q: Is the check result normal?

YES : Go to Step 3.

NO : Replace the oil feeder control valve.

STEP 3. Perform voltage measurement at A-101 oil feeder control valve connector.



Disconnect connector, and measure at harness side.

- Ignition switch: ON
- Voltage between terminal No. 1 and earth.

OK: System voltage

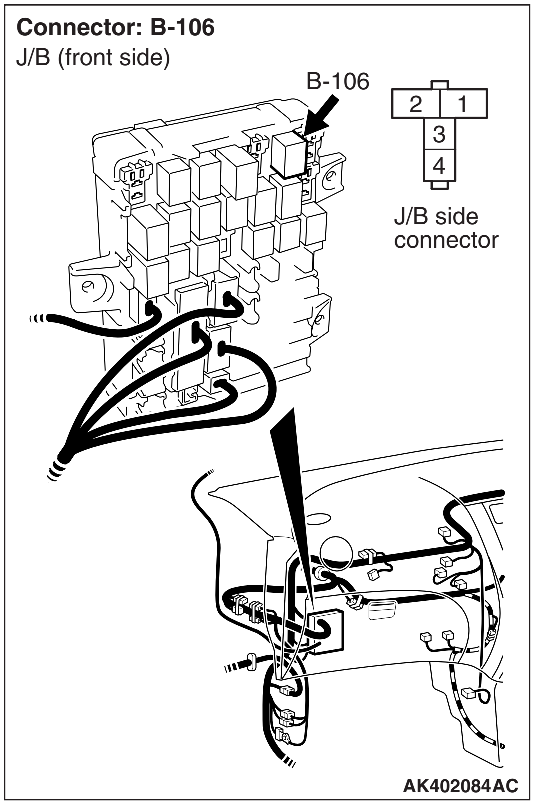
Q: Is the check result normal?

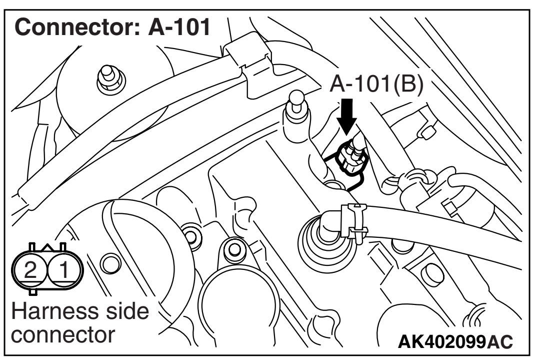
YES : Go to Step 5.

NO : Go to Step 4.

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STEP 4. Connector check: B-106 engine control relay connector





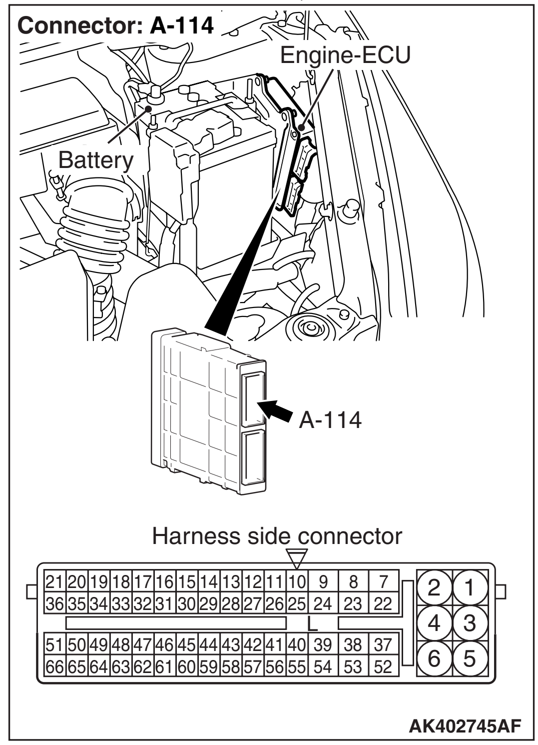
Q: Is the check result normal?

YES : Check the intermediate connectors A-17 and B-112, and repair them if necessary. If the intermediate connectors are normal, check and repair the harness between B-106 (terminal No. 4) engine control relay connector and A-101 (terminal No. 1) oil feeder control valve connector

- Check power supply line for open/short circuit.

NO : Repair or replace.

STEP 5. Perform voltage measurement at A-114 engine-ECU connector.



Disconnect connector and measure at harness side.

- Ignition switch: ON
- Voltage between terminal No. 52 and earth.

OK: System voltage

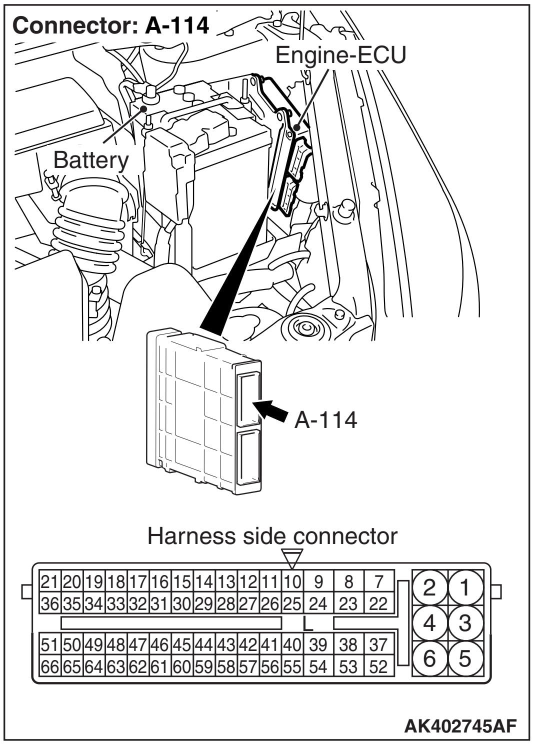
Q: Is the check result normal?

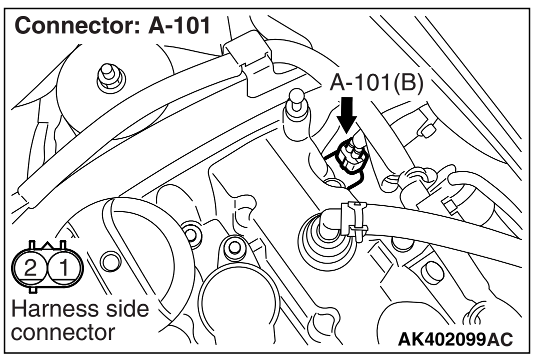
YES : Go to Step 7.

NO : Go to Step 6.

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STEP 6. Connector check: B-114 engine-ECU connector





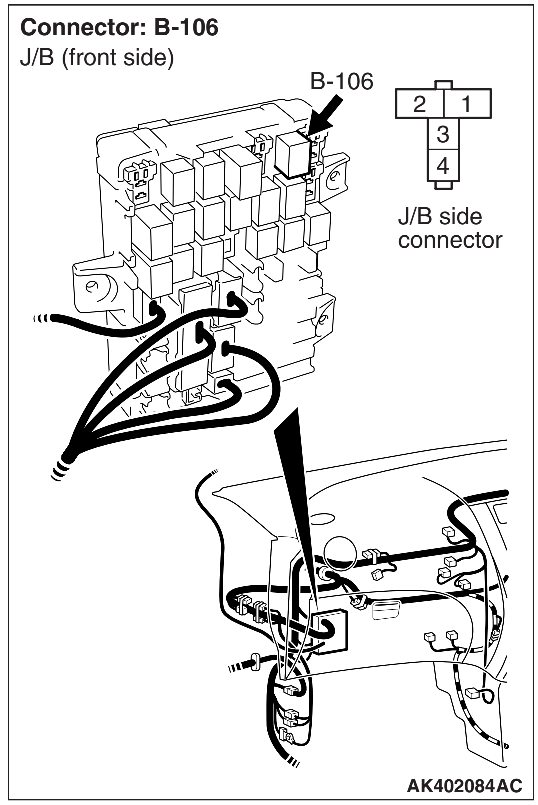
Q: Is the check result normal?

YES : Check and repair the harness between A-101 (terminal No. 2) oil feeder control valve connector and A-114 (terminal No. 52) engine-ECU connector.

- Check output line for open/short circuit.

NO : Repair or replace.

STEP 7. Connector check: B-106 engine control relay connector



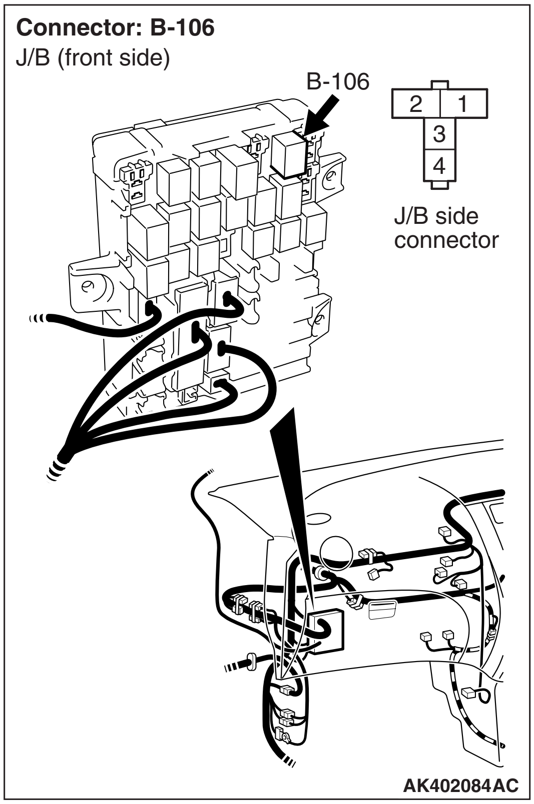
Q: Is the check result normal?

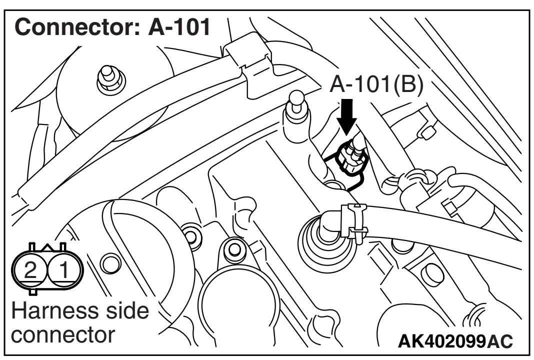
YES : Go to Step 8.

NO : Repair or replace.

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STEP 8. Check harness between B-106 (terminal No. 4) engine control relay connector and A-101 (terminal No. 1) oil feeder control valve connector.



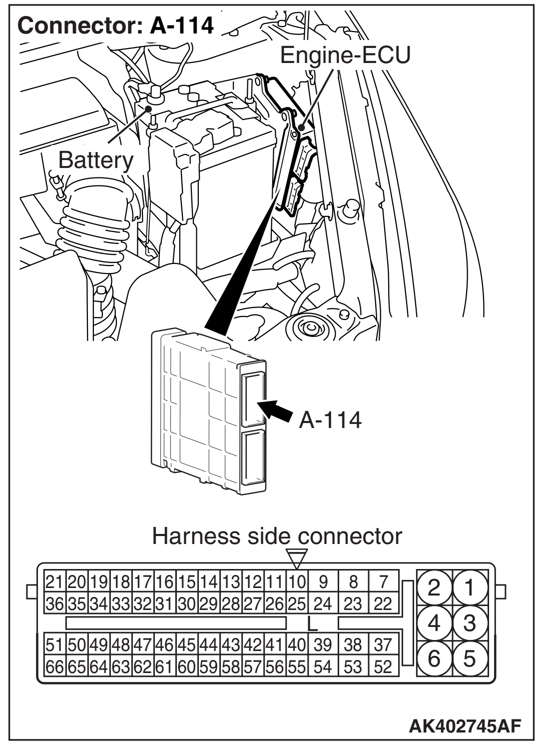


NOTE: Before checking harness, check intermediate connectors A-17 and B-112, and repair them if necessary.

- Check power supply line for damage.

Q: Is the check result normal?
YES : Go to Step 9.
NO : Repair.

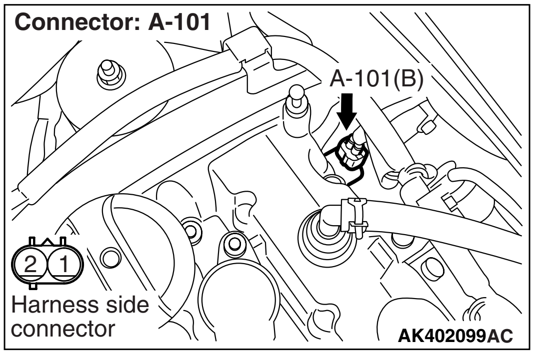
STEP 9. Connector check: A-114 engine-ECU connector

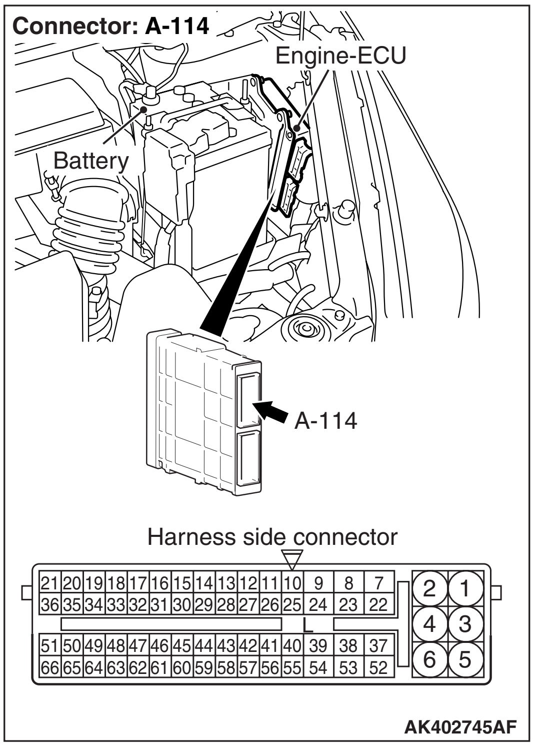


Q: Is the check result normal?
YES : Go to Step 10.
NO : Repair or replace.

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STEP 10. Check harness between A-101 (terminal No. 2) oil feeder control valve connector and A-114 (terminal No. 52) engine-ECU connector.





Check output line for damage.

Q: Is the check result normal?

YES : Go to Step 11.

NO : Repair.

STEP 11. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Q: Is the diagnosis code output?

YES : Replace engine-ECU.

NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

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Code No. P1231: Trustful Check ASC <Vehicle with ASC>

FUNCTION

- Confirm abnormal signals of ASC through CAN communication.

TROUBLE JUDGMENT

Check Condition

- Ignition switch is "ON" position.

Judgment Criterion

- The torque request signal from ASC-ECU is abnormal.

PROBABLE CAUSES

- Failed ASC-ECU
- Failed CAN
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

Q: Is diagnosis code related with CAN communication displayed?

YES : Inspection chart for diagnosis code (Refer to P.13B-18).

NO : Go to Step 2 .

STEP 2. M.U.T.-III other system diagnosis code

- Confirm whether the diagnosis codes are output from ASC-ECU.

Q: Is the diagnosis code output?

YES : Perform the troubleshooting of ASC (Refer to Group 35C – Troubleshooting – Diagnosis Code Chart P.35C-6).

NO : Replace engine-ECU.

Code No. P1233: Trustful Check Throttle Position Sensor (Main)

FUNCTION

- Compare the actual measurement of volumetric efficiency by an air flow sensor signal with volumetric efficiency estimated from a throttle position sensor (main) signal.

TROUBLE JUDGMENT

Check Conditions

- Ignition switch is in "ON" position.
- The air flow sensor is normal.

Judgment Criterion

- The difference between volumetric efficiency (actual measurement) by the air flow sensor and volumetric efficiency estimated from the throttle position sensor (main) exceeds the specified value.

PROBABLE CAUSES

- Failed throttle position sensor (main)
- Harness damage in throttle position sensor (main) circuit or loose connector contact
- Failed intake air system
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

Q: Is any other diagnosis code than P1233 output?

YES : Inspection chart for diagnosis code (Refer to P.13B-18).

NO : Go to Step 2 .

STEP 2. M.U.T.-III data list

- Refer to Data List Reference Table P.13B-335.
  a. Item No. 79: Throttle position sensor (main)

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

NO : Go to Step 3 .

STEP 3. Check air intake from intake hose and inlet manifold.

Q: Is the check result normal?

YES : Replace the engine-ECU.

NO : Repair.

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Group TOC

Code No. P1234: Trustful Check Throttle Position Sensor (Sub)

FUNCTION

- Compare the actual measurement of volumetric efficiency by an air flow sensor signal with volumetric efficiency estimated from a throttle position sensor (sub) signal.

TROUBLE JUDGMENT

Check Conditions

- Ignition switch is in "ON" position.
- The air flow sensor is normal.

Judgment Criterion

- The difference between volumetric efficiency (actual measurement) by the air flow sensor and volumetric efficiency estimated from the throttle position sensor (sub) exceeds the specified value.

PROBABLE CAUSES

- Failed throttle position sensor (sub)
- Harness damage in throttle position sensor (sub) circuit or loose connector contact
- Failed intake air system
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

Q: Is any other diagnosis code than P1234 output?

YES : Inspection chart for diagnosis code (Refer to P.13B-18).

NO : Go to Step 2 .

STEP 2. M.U.T.-III data list

- Refer to Data List Reference Table P.13B-335.
  a. Item No. 14: Throttle position sensor (sub)

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

NO : Go to Step 3 .

STEP 3. Check air intake from intake hose and inlet manifold.

Q: Is the check result normal?

YES : Replace the engine-ECU.

NO : Repair.

Code No. P1235: Trustful Check Air Flow Sensor

FUNCTION

- Compare the actual measurement of volumetric efficiency by an air flow sensor signal with volumetric efficiency estimated from a throttle position sensor (main or sub) signal.

TROUBLE JUDGMENT

Check Conditions

- While engine is running.
- The throttle position sensor (main or sub) is normal.
- The air flow sensor is normal.

Judgment Criteria

- The difference between volumetric efficiency estimated from the throttle position sensor (main) and volumetric efficiency estimated from the throttle position sensor (sub) exceeds the specified value.
- The difference between volumetric efficiency (actual measurement) by the air flow sensor and volumetric efficiency estimated from the throttle position sensor (main) exceeds the specified value.
- The difference between volumetric efficiency (actual measurement) by the air flow sensor and volumetric efficiency estimated from the throttle position sensor (sub) exceeds the specified value.

PROBABLE CAUSES

- Failed air flow sensor
- Damage in air flow sensor circuit or loose connector contact
- Failed intake air system
- Failed engine-ECU

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Group TOC

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

Q: Is any other diagnosis code than P1235 output?

YES : Inspection chart for diagnosis code (Refer to P.13B-18).

NO : Go to Step 2 .

STEP 2. M.U.T.-III data list

- Refer to Data List Reference Table P.13B-335.
  a. Item No. 12: Air flow sensor

Q: Is the check result normal?

YES : Replace the engine-ECU.

NO : Check air flow sensor system (Refer to Code No. P0100 P.13B-31).

Code No. P1236: AD Converter

FUNCTION

- The input voltage from the accelerator pedal position sensor (sub) is monitored whether which is converted normally into the digital signal within engine-ECU.

TROUBLE JUDGMENT

Check Condition

- Ignition switch is "ON" position.

Judgment Criterion

- When the input voltage from the accelerator pedal position sensor (sub) is periodically 0 V, the input voltage digital value shows more than 0.2 V.

PROBABLE CAUSE

- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

- After clearing the diagnosis code through M.U.T.-III, ignition switch is "ON" position and confirm whether the diagnosis code is output.

Q: Diagnosis code set?

YES : Replace engine-ECU.

NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

Code No. P1237: Trustful Check Accelerator Pedal Position Sensor

FUNCTION

- Compare accelerator pedal position sensor (main) output with accelerator pedal position sensor (sub) one.

TROUBLE JUDGMENT

Check Conditions

- Ignition switch is "ON" position.

Judgment Criteria

- Difference is more than specified value between output voltage of accelerator pedal position sensor (main) and output voltage multiplied by 2 of accelerator pedal position sensor (sub).
- When accelerator pedal position sensor (main) output voltage is constant, change amount of accelerator pedal position sensor (sub) output voltage is more than specified value.

PROBABLE CAUSES

- Failed accelerator pedal position sensor
- Damaged accelerator pedal position sensor circuit
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

Q: Diagnosis code set?

YES : Inspection chart for diagnosis code (Refer to P.13B-18).

NO : Go to Step 2 .

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STEP 2. M.U.T.-III data list

- Refer to Data List Reference Table P.13B-335.
  a. Item No. 78: Accelerator pedal position sensor (main)
  b. Item No. 77: Accelerator pedal position sensor (sub)

Q: Are the check results normal?

YES : Replace engine-ECU.

NO : Perform the diagnosis code classified check procedure for the sensor that has shown an abnormal data value (Refer to Inspection Chart for Diagnosis Code P.13B-18).

Code No. P1238: Air Flow Sensor Trustful For Torque Monitoring

FUNCTION

- Compare the actual measurement of volumetric efficiency by an air flow sensor signal with volumetric efficiency estimated from a throttle position sensor (main or sub) signal.

TROUBLE JUDGMENT

Check Conditions

- Ignition switch is in "ON" position.
- While engine is running.
- Throttle position sensor (main or sub) is normal.

Judgment Criteria

- The difference between volumetric efficiency estimated from the throttle position sensor (main) and volumetric efficiency estimated from the throttle position sensor (sub) exceeds the specified value.
- The difference between volumetric efficiency (actual measurement) by the air flow sensor and volumetric efficiency estimated from the throttle position sensor (main) exceeds the specified value.
- The difference between volumetric efficiency (actual measurement) by the air flow sensor and volumetric efficiency estimated from the throttle position sensor (sub) exceeds the specified value.

PROBABLE CAUSES

- Failed air flow sensor
- Damage in air flow sensor circuit or loose connector contact
- Failed intake air system
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

Q: Is any other diagnosis code than P1238 output?

YES : Inspection chart for diagnosis code (Refer to P.13B-18).

NO : Go to Step 2 .

STEP 2. M.U.T.-III data list

- Refer to Data List Reference Table P.13B-335.
  a. Item No. 12: Air flow sensor

Q: Is the check result normal?

YES : Replace the engine-ECU.

NO : Check air flow sensor system (Refer to Code No. P0100 P.13B-31).

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Code No. P1239: Trustful Check Engine Speed

FUNCTION

- Compare the actual engine speed through the crank angle sensor signal trip with the assumed engine speed through the crank angle sensor signal pulse number after the specified period.

TROUBLE JUDGMENT

Check Condition

- While engine is running.

Judgment Criterion

- Difference is more than 500 r/min between actual engine speed and supposed engine speed.

PROBABLE CAUSE

- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

- After clearing the diagnosis code through M.U.T.-III, start the engine and confirm whether the diagnosis code is output.

Q: Diagnosis code set?

YES : Replace engine-ECU.

NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

Code No. P1240: Trustful Check Engine Speed <Vehicle with ASC>

FUNCTION

- The ignition timing retard request signal is abnormal from ASC-ECU.

TROUBLE JUDGMENT

Check Condition

- Ignition switch is "ON" position.

Judgment Criterion

- Retard request signal for ignition timing is abnormal.

PROBABLE CAUSES

- Failed ASC-ECU
- Failed CAN
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

Q: Is diagnosis code related with CAN communication displayed?

YES : Inspection chart for diagnosis code (Refer to P.13B-18).

NO : Go to Step 2 .

STEP 2. M.U.T.-III other system diagnosis code

- Confirm whether the diagnosis codes are output from ASC-ECU.

Q: Is the diagnosis code output?

YES : Perform the troubleshooting of ASC (Refer to Group 35C –Troubleshooting – Diagnosis Code Chart P.35C-6).

NO : Replace engine-ECU.

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Code No. P1241: Torque Monitoring

FUNCTION

- Compare the difference between the actual torque signal and the requested torque signal.

TROUBLE JUDGMENT

Check Condition

- Ignition switch is "ON" position.

Judgment Criterion

- Difference is more than specified value between actual torque signal and target torque signal.

PROBABLE CAUSE

- Failed air flow sensor
- Failed accelerator pedal position sensor
- AIr drawn in from gaps in gasket, seals, etc.
- Failed throttle valve control servo
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

Q: Diagnosis code set?

YES : Inspection chart for diagnosis code (Refer to P.13B-18).

NO : Go to Step 2 .

STEP 2. M.U.T.-III data list

- Refer to Data List Reference Table P.13B-335.
  a. Item No. 78: Accelerator pedal position sensor (main)
  b. Item No. 77: Accelerator pedal position sensor (sub)
  c. Item No. 12: Air flow sensor

Q: Is the check results normal?

YES : Go to Step 3 .

NO : Perform the diagnosis code classified check procedure for the sensor that has shown an abnormal data value (Refer to Inspection Chart for Diagnosis Code P.13B-18).

STEP 3. Check for intake of air from gaps in gasket, seals, etc.

Q: Is the check result normal?

YES : Go to Step 4 .

NO : Repair for intake of air from gaps in gasket, seals, etc.

STEP 4. Check the throttle valve control servo itself.

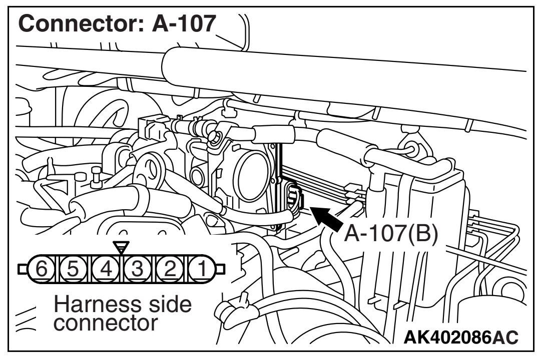
- Check the throttle valve control servo itself (Refer to P.13B-368)

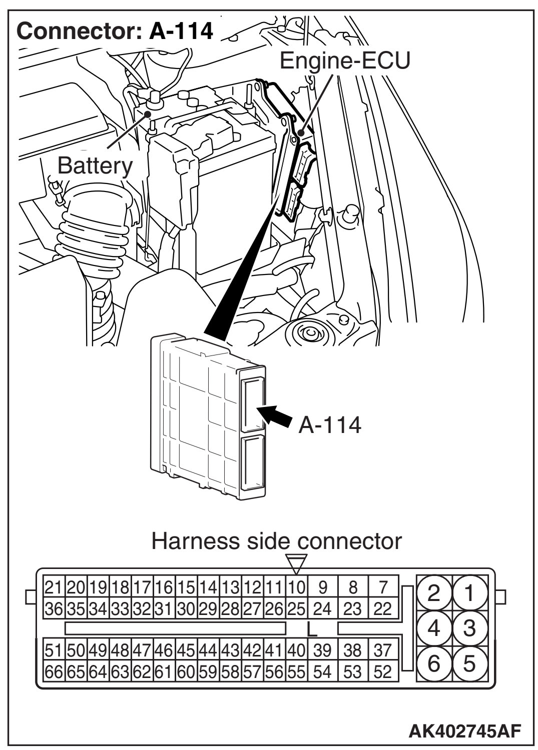
Q: Is the check result normal?

YES : Go to Step 5 .

NO : Replace the throttle body assembly.

STEP 5. Connector check: A-107 electronic-controlled throttle valve connector and A-114 engine-ECU connector.





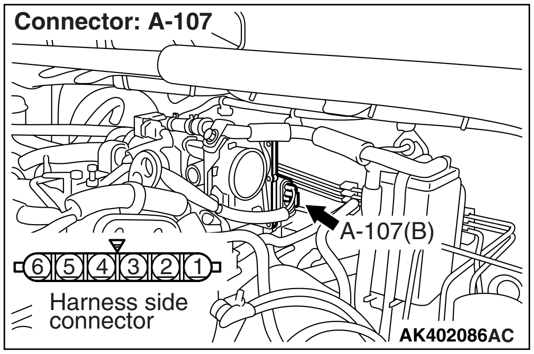
Q: Is the check result normal?

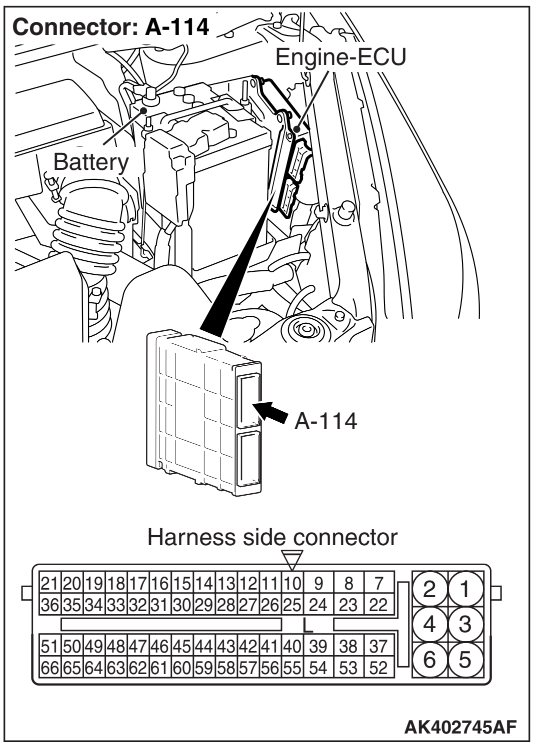
YES : Go to Step 6 .

NO : Repair or replace the connector.

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STEP 6. Check harness between A-107 (terminal No. 6) electronic-controlled throttle valve connector and A-114 (terminal No. 7) engine-ECU connector.





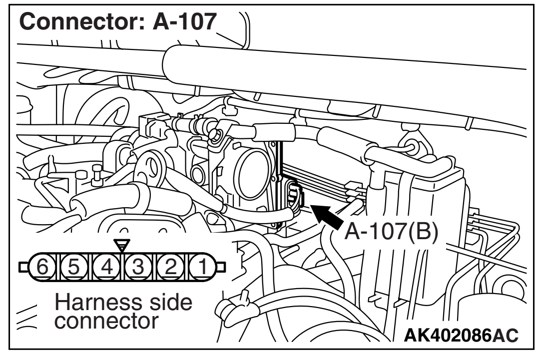
- Check output line for damage.

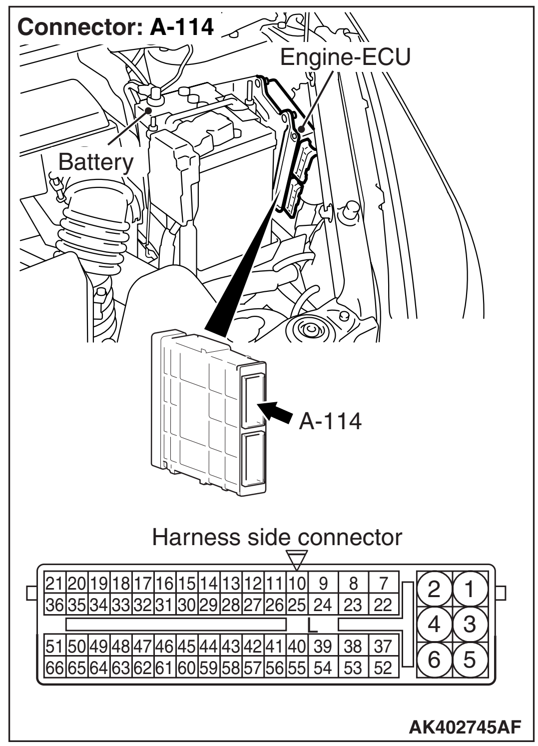
Q: Is the check result normal?

YES : Go to Step 7 .

NO : Repair the damaged harness wire.

STEP 7. Check harness between A-107 (terminal No. 5) electronic-controlled throttle valve connector and A-114 (terminal No. 22) engine-ECU connector.





- Check output line for damage.

Q: Is the check result normal?

YES : Go to Step 8 .

NO : Repair the damaged harness wire.

STEP 8. M.U.T.-III diagnosis code.

- Reconfirmation of diagnosis code.

Q: Is the diagnosis code set?

YES : Replace engine-ECU.

NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

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Code No. P1602: Communication Malfunction (between Engine-ECU Main Processor and System LSI)

FUNCTION

- Engine-ECU checks the communication status for abnormal conditions.

TROUBLE JUDGMENT

Check Conditions

- Ignition switch is ON position.

Judgement Criteria

- The communication between Main microcomputer and system LSI is abnormal.

PROBALE CAUSE

- Failed engine-ECU <M/T>

DIAGNOSIS

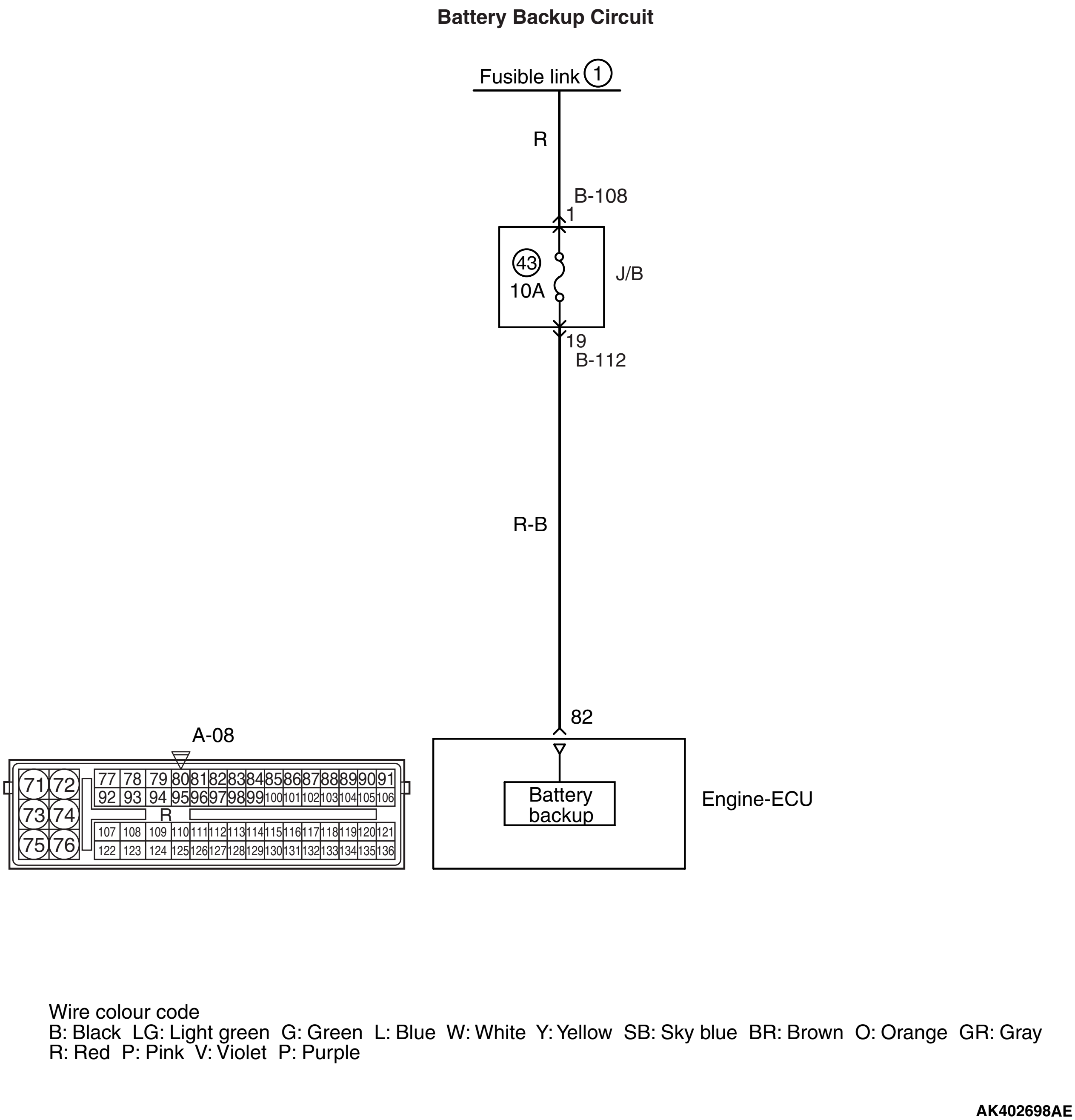
STEP 1. Check the trouble symptoms.

Q: Does trouble symptom persist?

YES : Replace engine-ECU.

NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

Code No. P1603: Battery Backup Circuit Malfunction



OPERATION

- Power is directly supplied to the engine-ECU (terminal No. 82) from the battery.

FUNCTION

- The engine-ECU checks the open circuit of battery backup line.

TROUBLE JUDGMENT

Check Conditions

- Ignition switch is in "ON" position.

Judgment Criterion

- For 2 seconds, battery backup voltage is less than 6.

PROBABLE CAUSES

- Open/short circuit and damage in battery backup line circuit or loose connector contact
- Failed engine-ECU

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DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

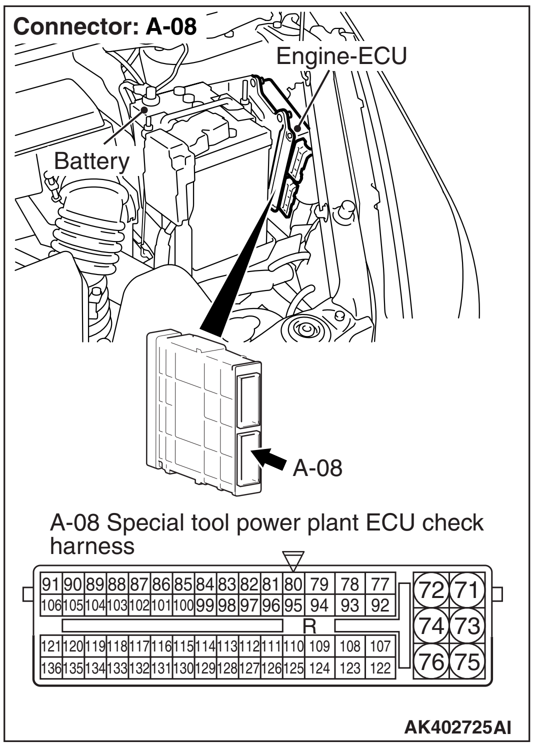
- Temporarily place the ignition switch in "LOCK" (OFF) position, and 10 seconds after that, place it in "ON" position again.

Q: Is the diagnosis code P1603 set?

YES : Go to Step 2 .

NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

STEP 2. Perform voltage measurement at A-08 engine-ECU connector.



- Disconnect connector, and measure at harness side.
- Ignition switch: ON
- Voltage between terminal No. 82 and earth.

OK: System voltage

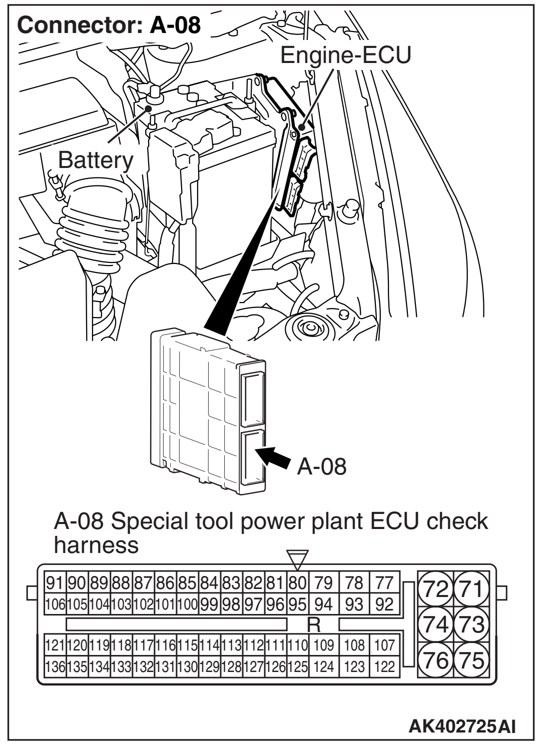
Q: Is the check result normal?

YES : Go to Step 3 .

NO : Check intermediate connector B-108 and B-112, and repair if necessary. If intermediate connector is normal, check and repair harness between battery and A-08 (terminal No. 82) engine-ECU connector.

- Check power supply line for open/short circuit.

STEP 3. Check harness between battery and A-08 (terminal No. 82) engine-ECU connector.



NOTE: Before checking harness, check intermediate connector B-108 and B-112, and repair if necessary.

- Check power supply line for damage.

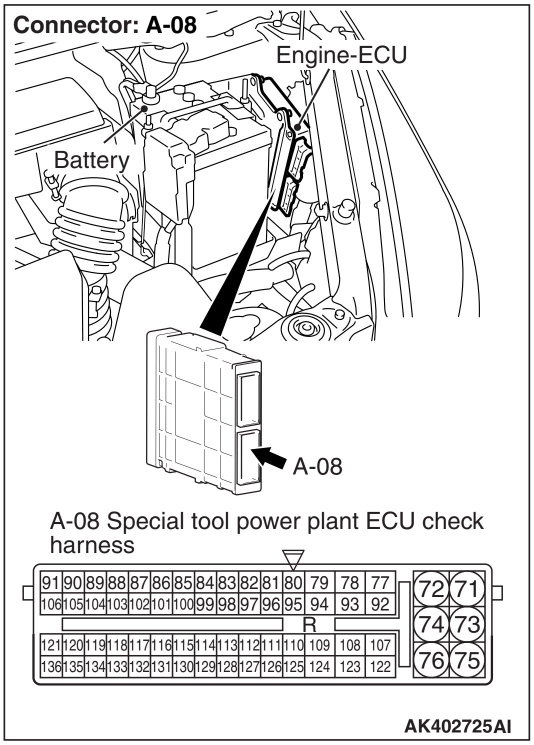
Q: Is the check result normal?

YES : Go to Step 4 .

NO : Repair the damaged harness wire.

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STEP 4. Connector check: A-08 engine-ECU connector



Q: Is the check result normal?

YES : Go to Step 5 .

NO : Repair or replace the connector.

STEP 5. M.U.T.-III diagnosis code.

- Reconfirmation of diagnosis code.

Q: Is the diagnosis code set?

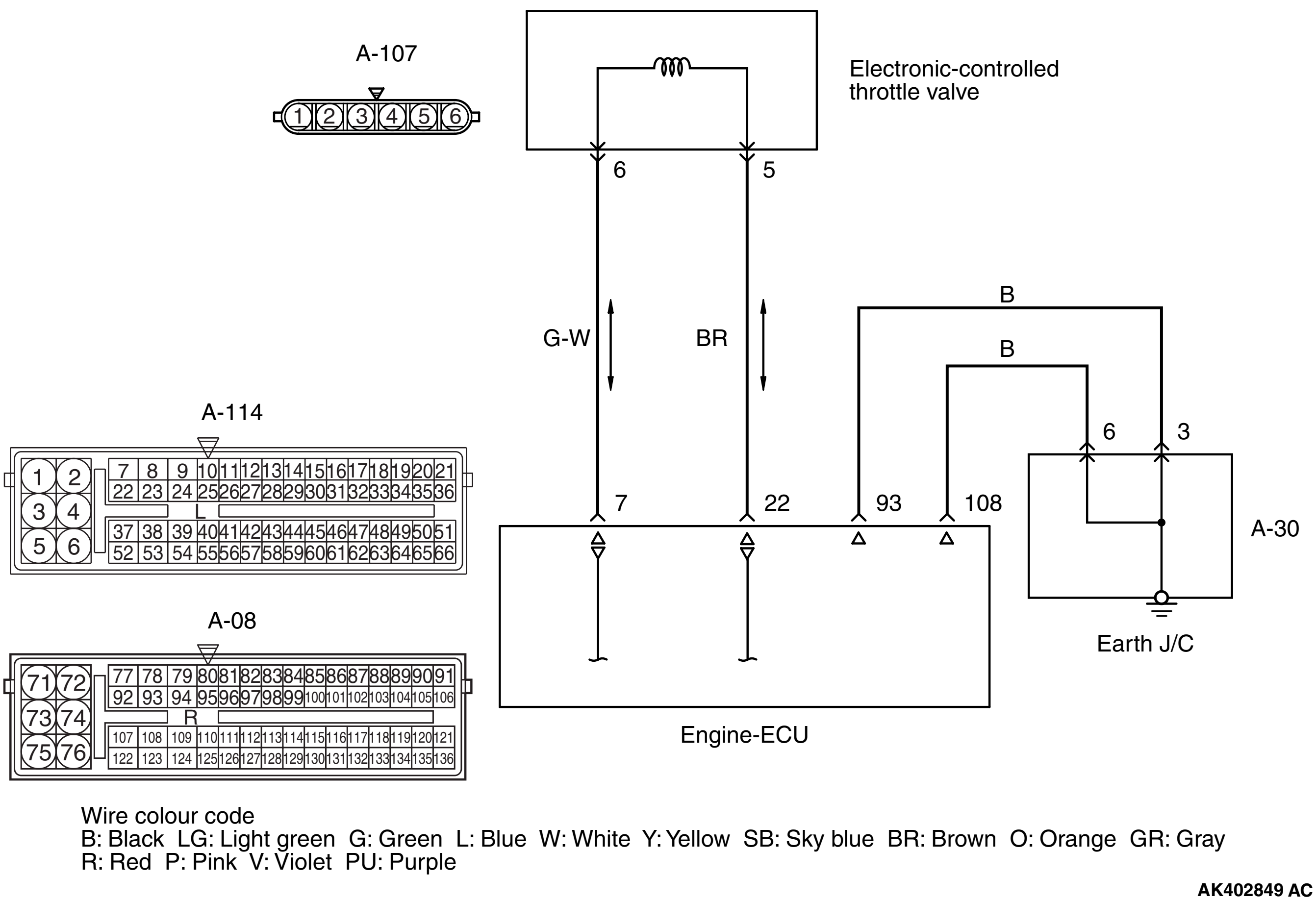
YES : Replace engine-ECU.

NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

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Code No. P2100: Throttle Valve Control Servo Circuit (open)

Throttle Valve Control Servo Circuit



OPERATION

- Controls the current that is applied from the engine-ECU (terminals No. 7, No. 22) to the electronic-controlled throttle valve (terminals No. 5, No. 6).

FUNCTION

- Engine-ECU varies the direction and the amperage of the current that is applied to the throttle valve control servo in order to control the opening of the throttle valve.

TROUBLE JUDGMENT

Check Conditions

- Ignition switch is in "ON" position.
- Throttle valve control servo supply voltage is more than 6.0 V.
- Battery voltage is more than 8.3 V.

Judgement Criterion

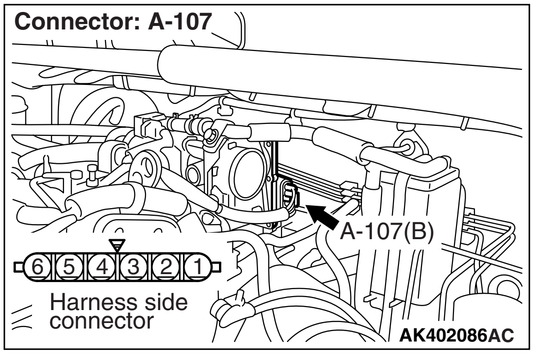
- There is deviation between throttle valve actual opening angle and target opening angle.

PROBABLE CAUSE

- Failed throttle valve control servo.
- Open/short circuit in throttle valve control servo circuit or lose connector contact.
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Connector check: A-107 electronic-controlled throttle valve connector

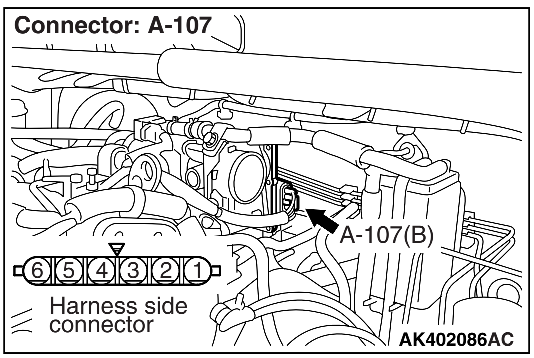


Q: Is the check result normal?

YES : Go to Step 2 .

NO : Repair or replace.

STEP 2. Perform resistance measurement at A-107 electronic-controlled throttle valve connector.



- Disconnect connector, and measure at electronic-controlled throttle valve side.
- Resistance between terminal No. 6 and No. 5.

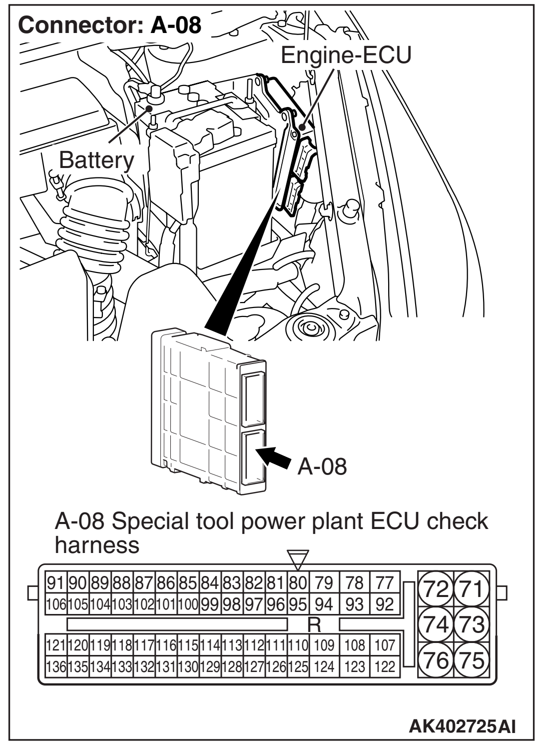
OK: 0.3 – 100 kΩ (at 20°C)

Q: Is the check result normal?

YES : Go to Step 3 .

NO : Replace throttle body assembly.

STEP 3. Connector check: A-08 engine-ECU connector



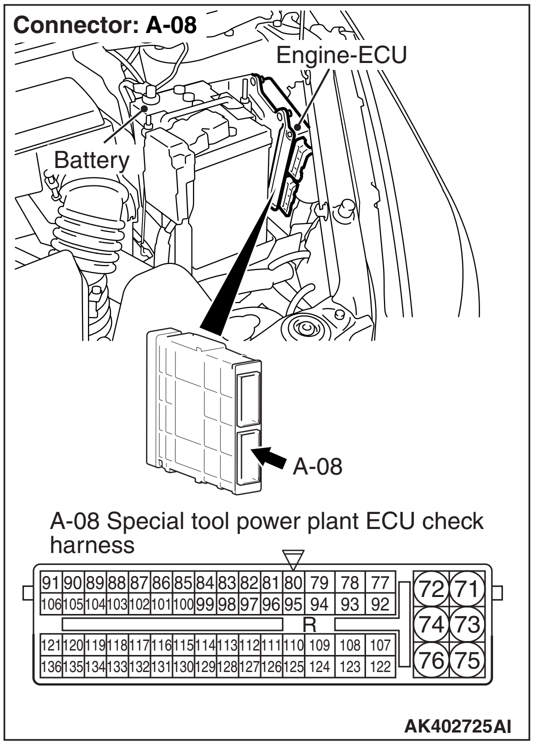
Q: Is the check result normal?

YES : Go to Step 4 .

NO : Repair or replace.

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STEP 4. Perform resistance measurement at A-08 engine-ECU connector.



- Disconnect connector and measure at harness side.
- Resistance between terminal No. 93, No. 108 and earth.

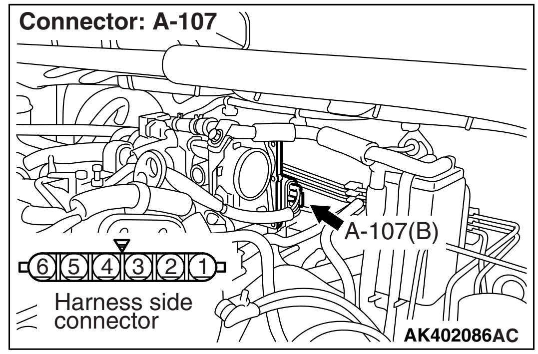
OK: Continuity (2 Ω or less)

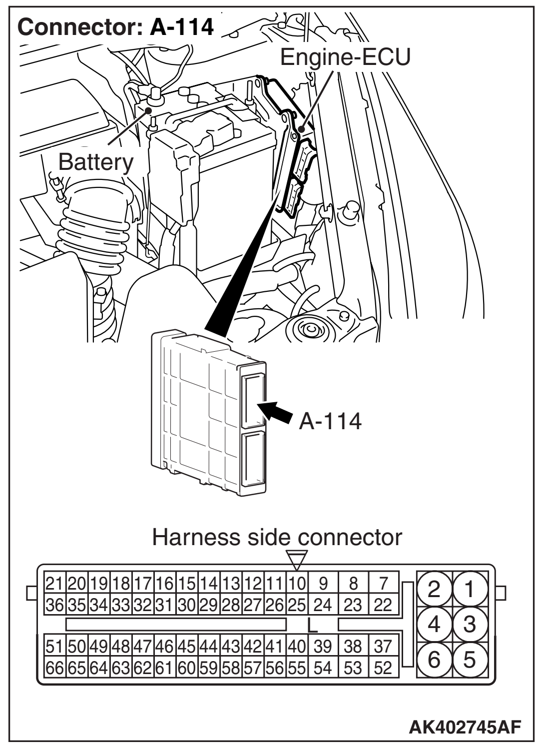
Q: Is the check result normal?

YES : Go to Step 5 .

NO :
- Check intermediate connector A-30, and repair if necessary. If intermediate connector is normal, check and repair harness between engine-ECU connector and earth.
  a. Check and repair harness between A-08 (terminal No. 93) engine-ECU connector and earth.
  b. Check and repair harness between A-08 (terminal No. 108) engine-ECU connector and earth.

STEP 5. Check harness between A-107 (terminal No. 6) electronic-controlled throttle valve connector and A-114 (terminal No. 7) engine-ECU connector.





- Check output line for short circuit and damage.

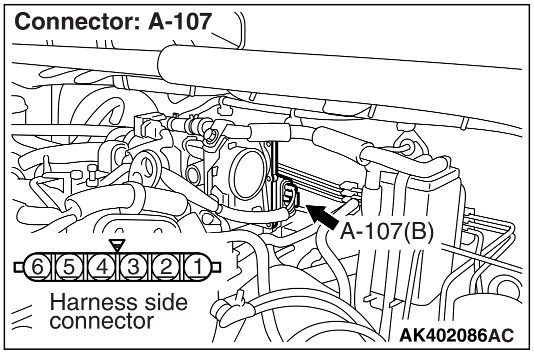
Q: Is the check result normal?

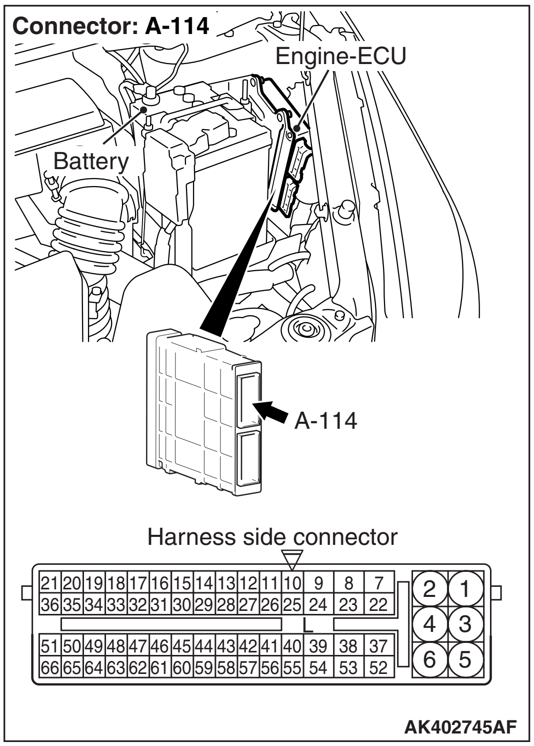
YES : Go to Step 6 .

NO : Repair.

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STEP 6. Check harness between A-107 (terminal No. 5) electronic-controlled throttle valve connector and A-114 (terminal No. 22) engine-ECU connector.





- Check output line for short circuit and damage.

Q: Is the check result normal?
YES : Go to Step 7 .
NO : Repair.

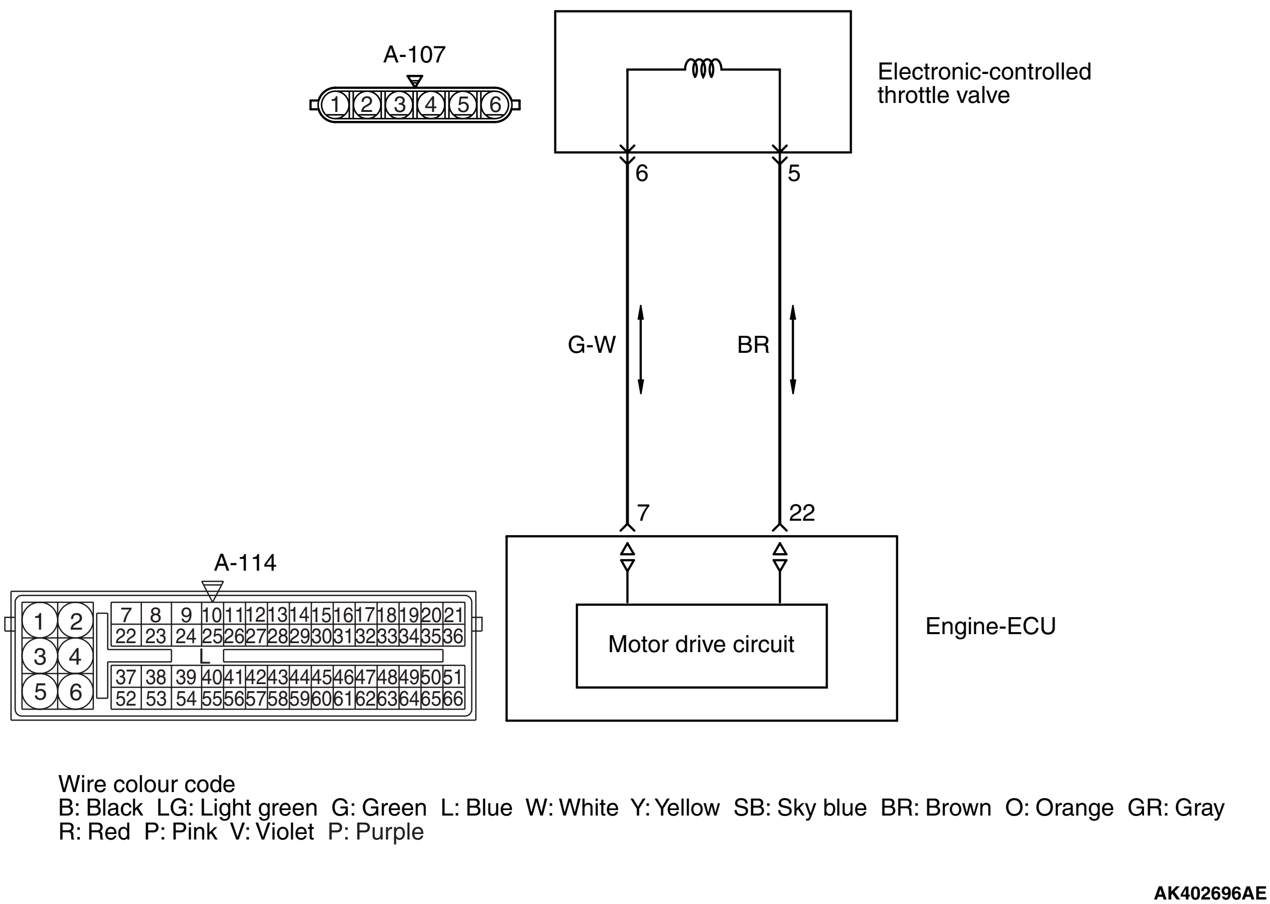
STEP 7. Check the trouble symptoms.

Q: Is the check result normal?
YES : Replace engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

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Code No. P2101: Throttle Valve Control Servo Magneto Malfunction

Throttle Valve Control Servo Circuit



OPERATION

- Controls the current that is applied from the engine-ECU (terminals No. 7, No. 22) to the electronic-controlled throttle valve (terminals No. 5, No. 6).

FUNCTION

- Engine-ECU check whether the throttle valve control servo magneto failed.

TROUBLE JUDGMENT

Check Conditions

- Ignition switch is in "ON" position.
- Battery voltage is more than 8.3 V.

Judgement Criterion

- Driving current of throttle valve control servo is abnormal.

Or

- Temperature in driving circuit of throttle valve control servo is abnormal.

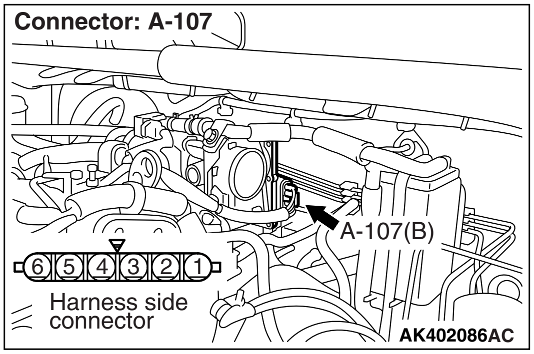
PROBABLE CAUSE

- Failed throttle valve control servo.
- Open/short circuit in throttle valve control servo circuit or lose connector contact.
- Failed engine-ECU

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DIAGNOSIS PROCEDURE

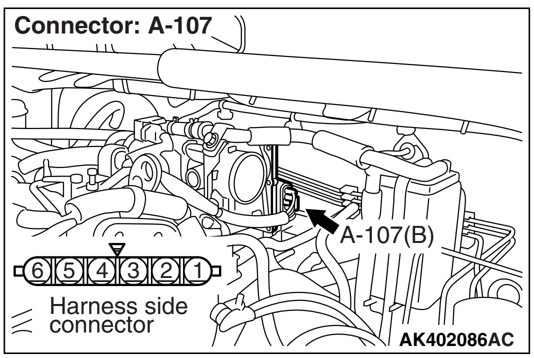
STEP 1. Connector check: A-107 electronic-controlled throttle valve connector



Q: Is the check result normal?

YES : Go to Step 2 .
NO : Repair or replace.

STEP 2. Perform resistance measurement at A-107 electronic-controlled throttle valve connector.



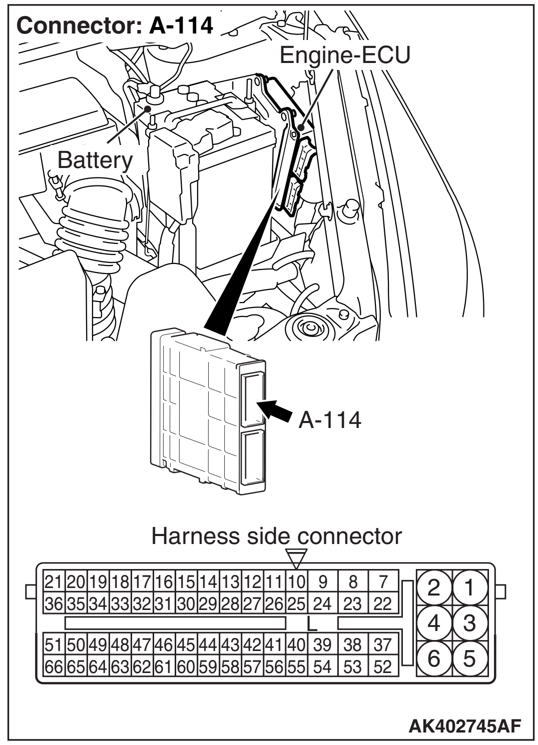
- Disconnect connector, and measure at electronic-controlled throttle valve side.
- Resistance between terminal No. 5 and No. 6.

OK: 0.3 – 100 kΩ (at 20°C)

Q: Is the check result normal?

YES : Go to Step 3 .
NO : Replace throttle body assembly.

STEP 3. Connector check: A-114 engine-ECU connector

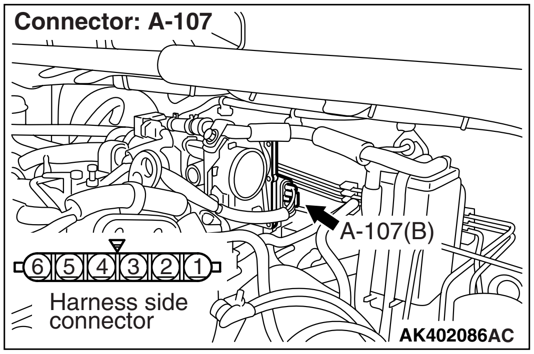


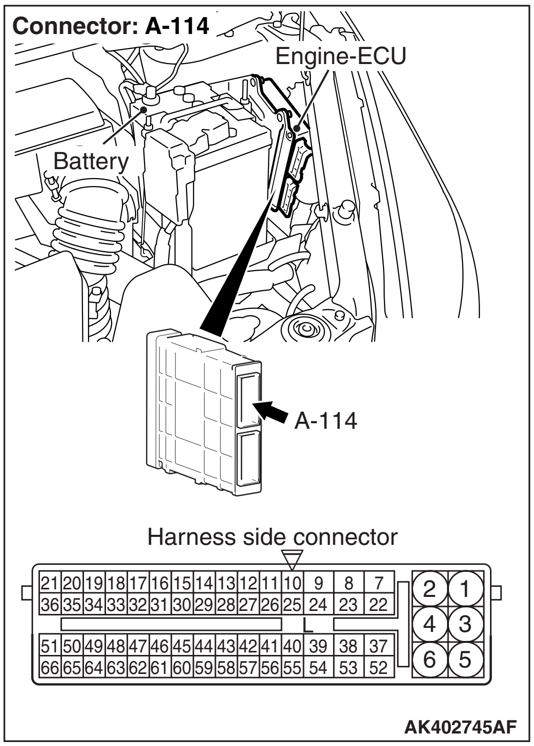
Q: Is the check result normal?

YES : Go to Step 4 .
NO : Repair or replace.

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STEP 4. Check harness between A-107 (terminal No. 6) electronic-controlled throttle valve connector and A-114 (terminal No. 7) engine-ECU connector.

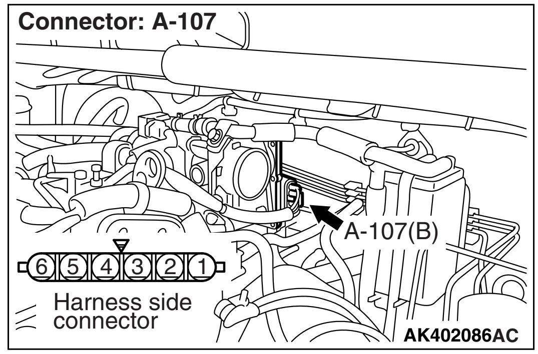


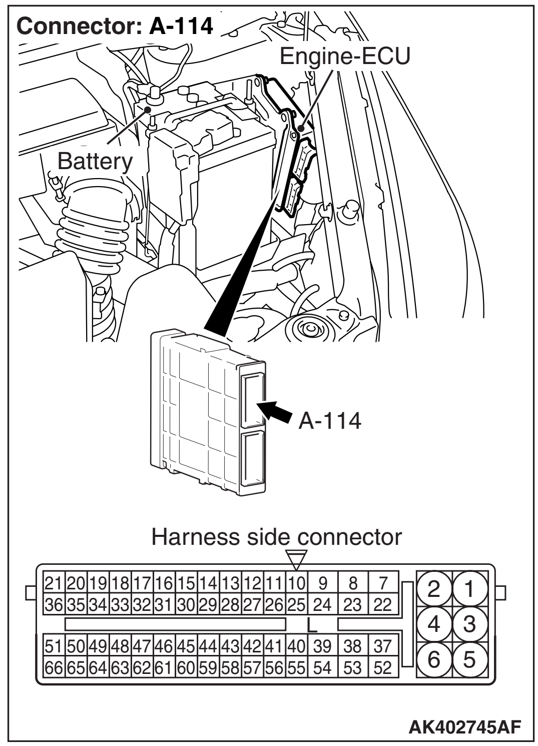


- Check output line for short circuit and damage.

Q: Is the check result normal?
YES : Go to Step 5 .
NO : Repair.

STEP 5. Check harness between A-107 (terminal No. 5) electronic-controlled throttle valve connector and A-114 (terminal No. 22) engine-ECU connector.





- Check output line for short circuit and damage.

Q: Is the check result normal?
YES : Go to Step 6 .
NO : Repair.

STEP 6. Check the trouble symptoms.

Q: Is the check result normal?
YES : Replace engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

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Code No. P2108: Throttle Valve Control Servo Processor Malfunction

FUNCTION

- The engine-ECU checks the throttle valve control servo processor for abnormal conditions.

TROUBLE JUDGMENT

Check Conditions

- Ignition switch is in "ON" position.
- Throttle position sensor (main) output voltage is more than 0.2 V and is less than 4.8 V.

Judgement Criterion

- Throttle position sensor (main) input interface is abnormal.

PROBABLE CAUSE

- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code.

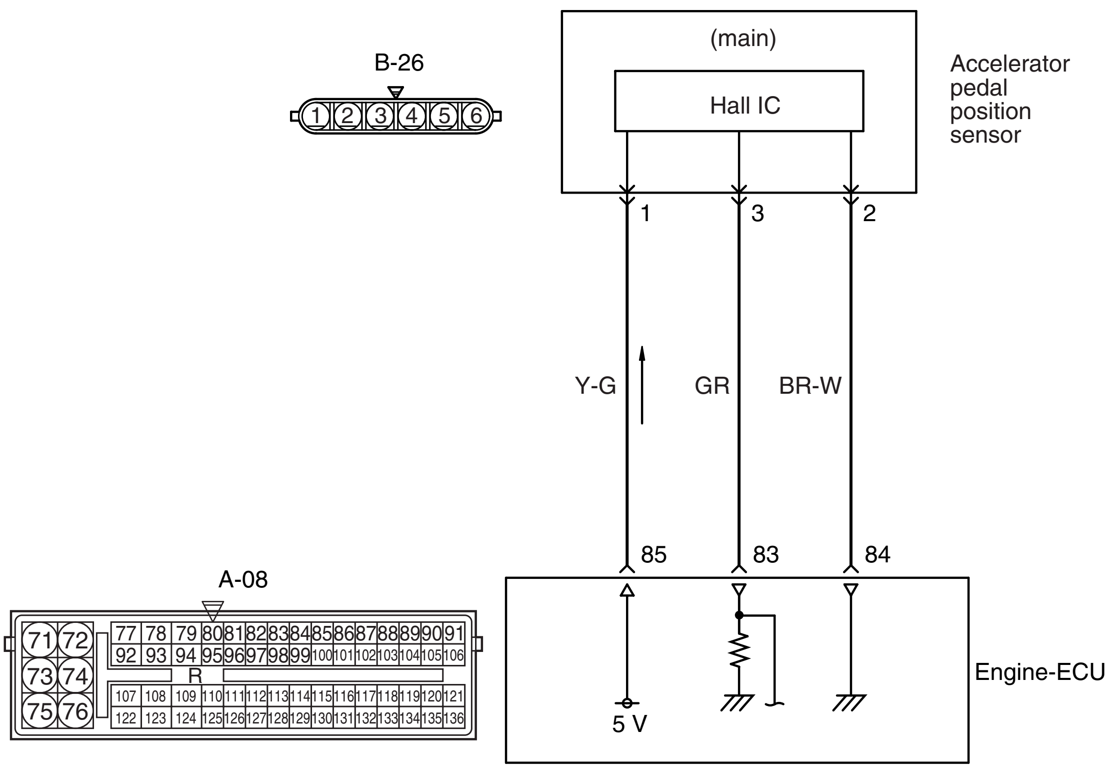
Q: Is any other diagnosis code than P2108 output?

YES : Inspection chart for diagnosis code (Refer to P.13B-18).

NO : Replace engine-ECU.

Code No. P2122: Accelerator Pedal Position Sensor (Main) Circuit Low Input

Accelerator Pedal Position Sensor (main) Circuit



Wire colour code
B: Black LG: Light green G: Green L: Blue W: White Y: Yellow SB: Sky blue BR: Brown O: Orange GR: Gray
R: Red P: Pink V: Violet P: Purple

AK402685AD

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OPERATION

- A power voltage of 5 V is applied to the accelerator pedal position sensor (terminal No. 1) from the engine-ECU (terminal No. 85).
- The power voltage is earthed to the engine-ECU (terminal No. 84) from the accelerator pedal position sensor (terminal No. 2).
- The sensor signal is inputted to the engine-ECU (terminal No. 83) from the accelerator pedal position sensor output terminal (terminal No. 3).

FUNCTION

- The accelerator pedal position sensor (main) outputs voltage which corresponds to the accelerator pedal depression.
- The engine-ECU checks whether the voltage is within a specified range.

TROUBLE JUDGMENT

Check Condition

- Ignition switch is in ON position.

Judgment Criterion

- Accelerator pedal position sensor (main) output voltage is less than 0.2 V.

PROBABLE CAUSE

- Failed accelerator pedal position sensor
- Open/short circuit in accelerator pedal position sensor circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list

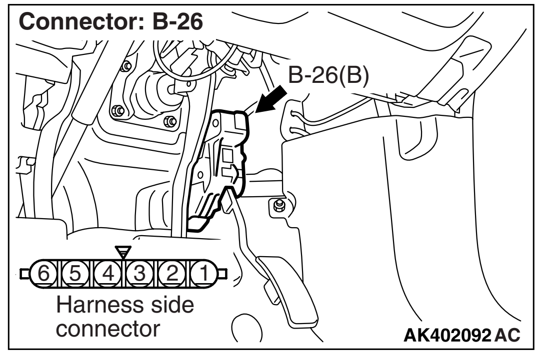
- Refer to Data List Reference Table P.13B-335.
  a. Item 78: Accelerator pedal position sensor (main)

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

NO : Go to Step 2 .

STEP 2. Connector check: B-26 accelerator pedal position sensor connector

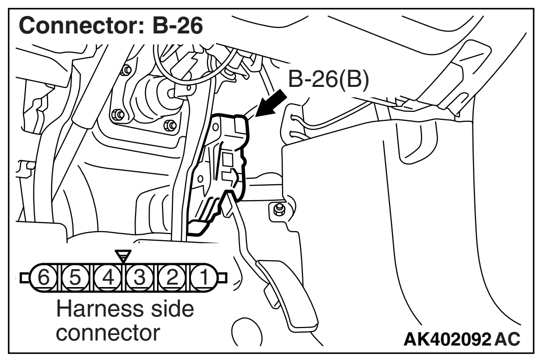


Q: Is the check result normal?

YES : Go to Step 3.

NO : Repair or replace.

STEP 3. Perform voltage measurement at B-26 accelerator pedal position sensor connector.



- Disconnect connector, and measure at harness side.
- Ignition switch: ON
- Voltage between terminal No. 1 and earth.

OK: 4.9 – 5.1 V

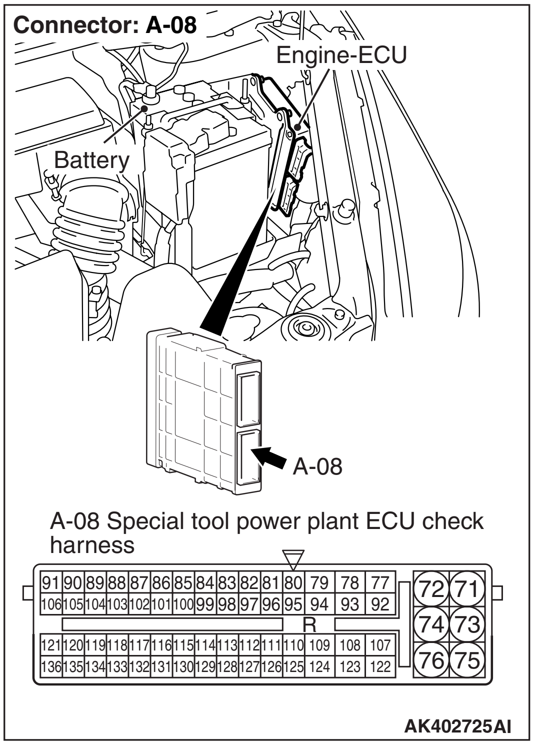
Q: Is the check result normal?

YES : Go to Step 7 .

NO : Go to Step 4 .

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STEP 4. Connector check: A-08 engine-ECU connector

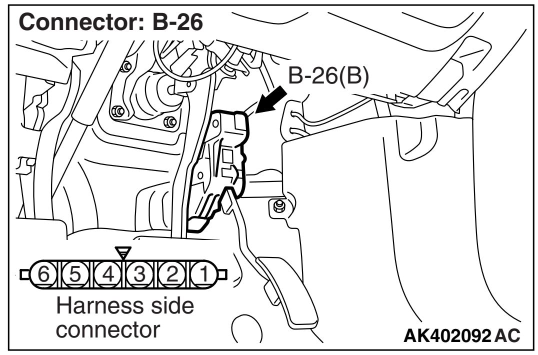


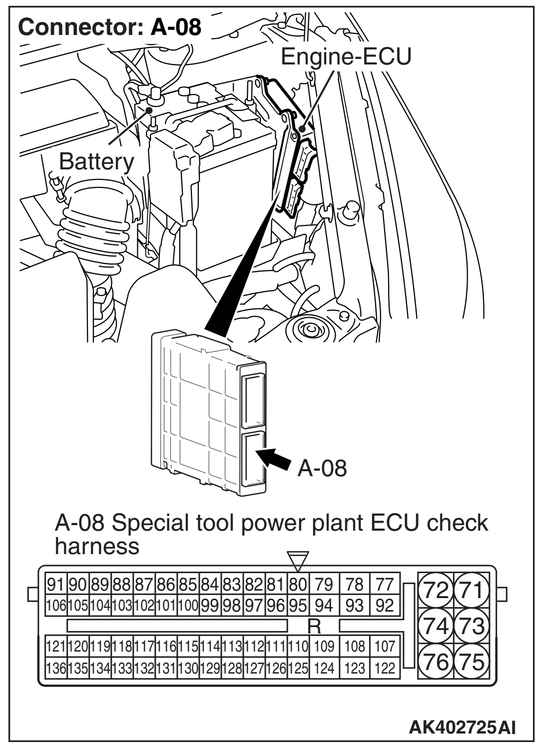
Q: Is the check result normal?

YES : Go to Step 5 .

NO : Repair or replace.

STEP 5. Check harness between B-26 (terminal No. 1) accelerator pedal position sensor connector and A-08 (terminal No. 85) engine-ECU connector.





Q: Is the check result normal?

YES : Go to Step 6 .

NO : Repair.

STEP 6. M.U.T.-III data list

- Refer to Data List Reference Table P.13B-335.
  a. Item 78: Accelerator pedal position sensor (main)

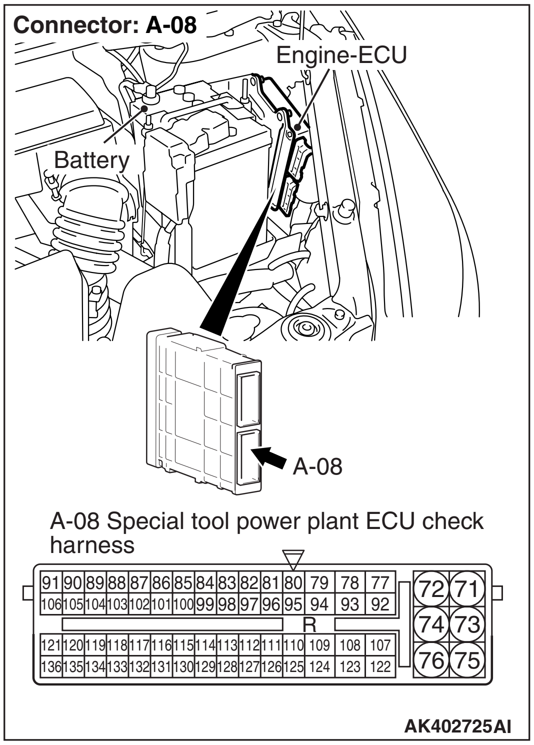
Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

NO : Replace engine-ECU.

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STEP 7. Connector check: A-08 engine-ECU connector

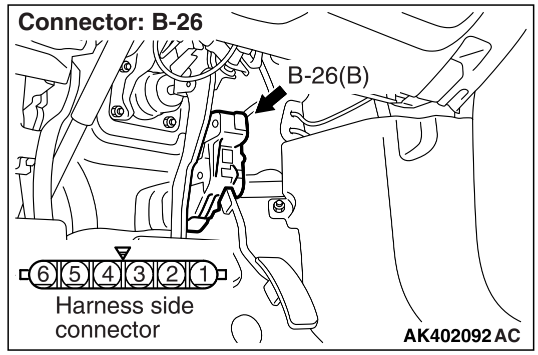


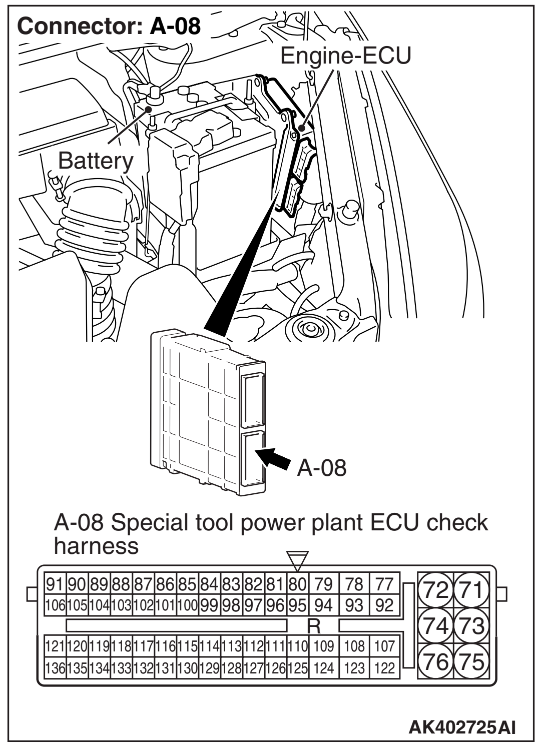
Q: Is the check result normal?

YES : Go to Step 8 .

NO : Repair or replace.

STEP 8. Check harness between B-26 (terminal No. 1) accelerator pedal position sensor connector and A-08 (terminal No. 85) engine-ECU connector.





- Check power supply line for damage.

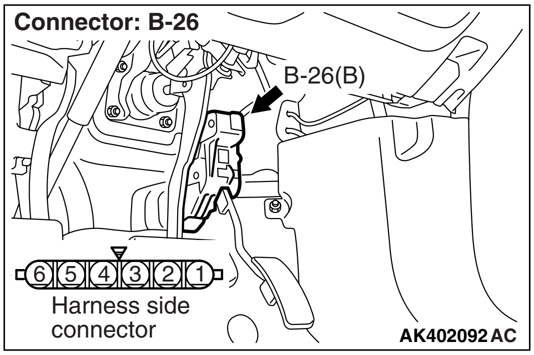
Q: Is the check result normal?

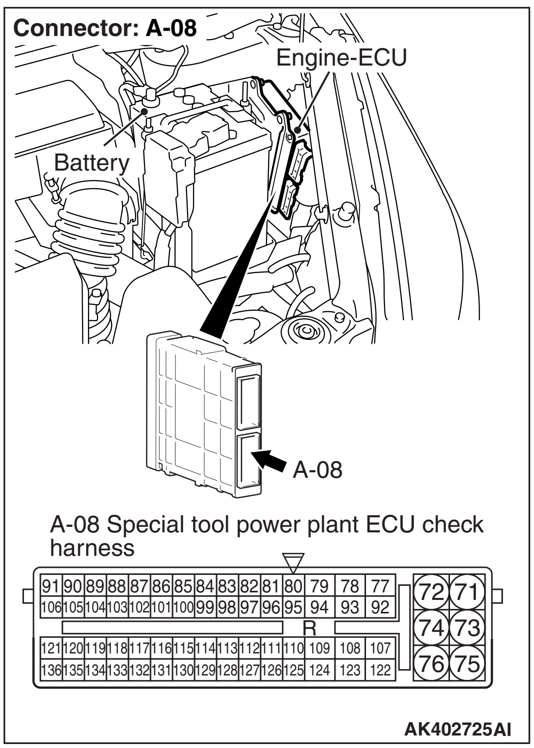
YES : Go to Step 9 .

NO : Repair.

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STEP 9. Check harness between B-26 (terminal No. 3) accelerator pedal position sensor connector and A-08 (terminal No. 83) engine-ECU connector.





- Check output line for damage.

Q: Is the check result normal?

YES : Go to Step 10 .

NO : Repair.

STEP 10. Replace the accelerator pedal assembly

- After replacing the accelerator pedal assembly, re-check the trouble symptoms.

Q: Is the check result normal?

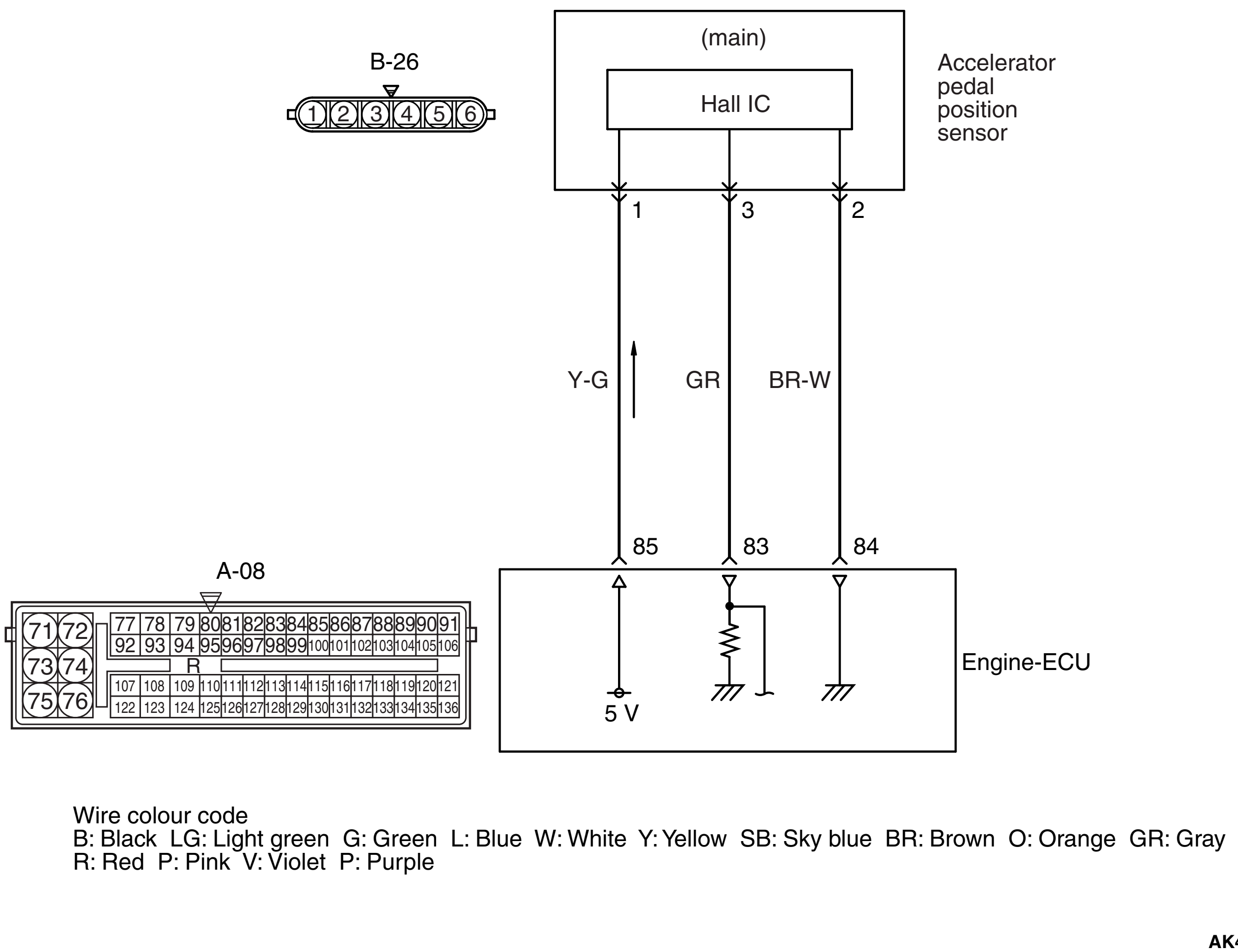
YES : Check end.

NO : Replace engine-ECU.

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Code No. P2123: Accelerator Pedal Position Sensor (Main) Circuit High Input

Accelerator Pedal Position Sensor (main) Circuit



OPERATION

- A power voltage of 5 V is applied to the accelerator pedal position sensor (terminal No. 1) from the engine-ECU (terminal No. 85).
- The power voltage is earthed to the engine-ECU (terminal No. 84) from the accelerator pedal position sensor (terminal No. 2).
- The sensor signal is inputted to the engine-ECU (terminal No. 83) from the accelerator pedal position sensor output terminal (terminal No. 3).

FUNCTION

- The accelerator pedal position sensor (main) outputs voltage which corresponds to the accelerator pedal depression.
- The engine-ECU checks whether the voltage is within a specified range.

TROUBLE JUDGMENT

Check Conditions

- Ignition switch is in ON position.

Judgment Criterion

- Accelerator pedal position sensor (main) output voltage is more than 4.8 V.

PROBABLE CAUSE

- Failed accelerator pedal position sensor
- Open/short circuit in accelerator pedal position sensor circuit or loose connector contact
- Failed engine-ECU

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DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list

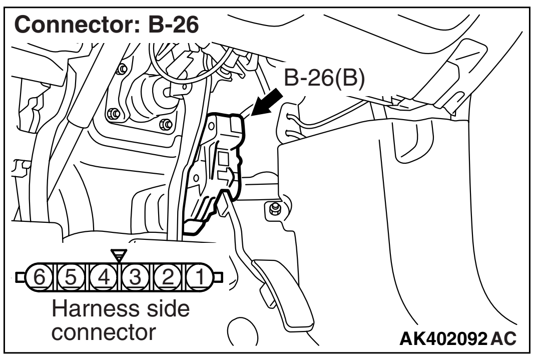
- Refer to Data List Reference Table P.13B-335.
    a. Item 78: Accelerator pedal position sensor (main)

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

NO : Go to Step 2 .

STEP 2. Connector check: B-26 accelerator pedal position sensor connector

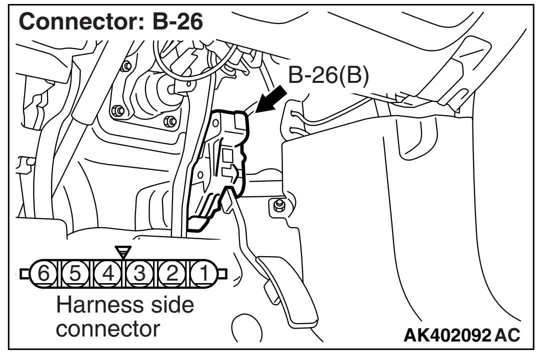


Q: Is the check result normal?

YES : Go to Step 3 .

NO : Repair or replace.

STEP 3. Perform resistance measurement at B-26 accelerator pedal position sensor connector.



- Disconnect connector, and measure at harness side.
- Resistance between terminal No. 2 and earth.

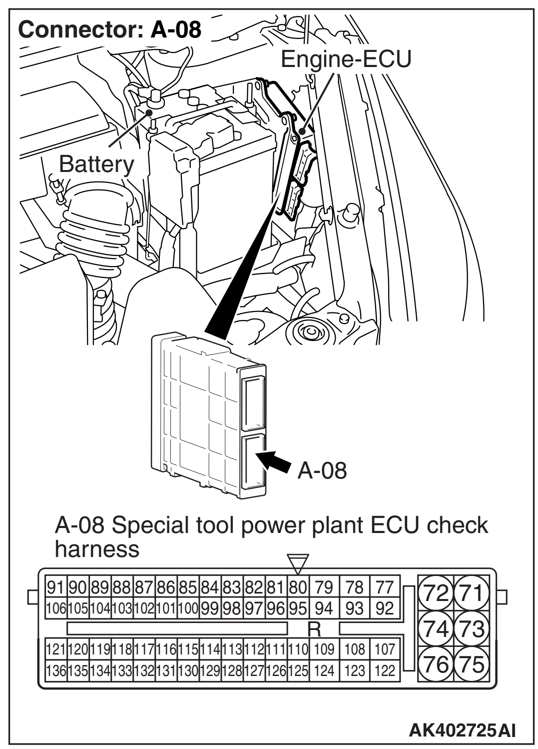
OK: Continuity (2 Ω or less)

Q: Is the check result normal?

YES : Go to Step 7 .

NO : Go to Step 4 .

STEP 4. Connector check: A-08 engine-ECU connector



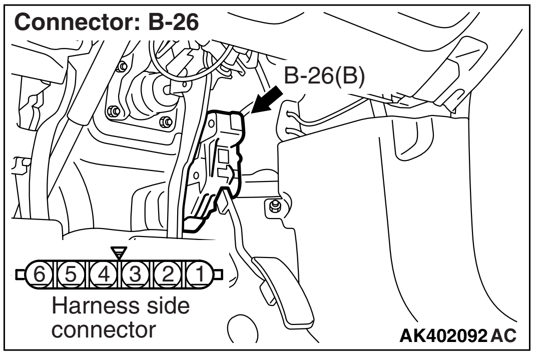
Q: Is the check result normal?

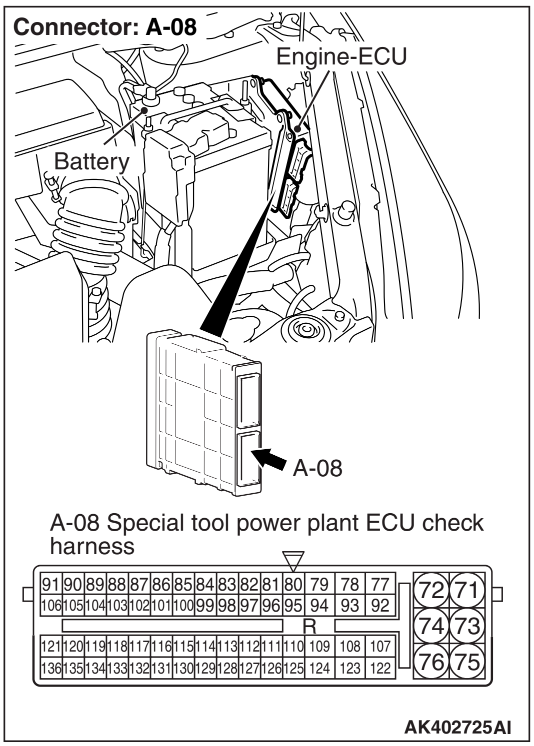
YES : Go to Step 5 .

NO : Repair or replace.

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STEP 5. Check harness between B-26 (terminal No. 2) accelerator pedal position sensor connector and A-08 (terminal No. 84) engine-ECU connector.





- Check earthing line for open circuit and damage.

Q: Is the check result normal?

YES : Go to Step 6 .
NO : Repair.

STEP 6. M.U.T.-III data list

- Refer to Data List Reference Table P.13B-335.
  a. Item 78: Accelerator pedal position sensor (main)

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).
NO : Replace engine-ECU.

STEP 7. Replace the accelerator pedal assembly

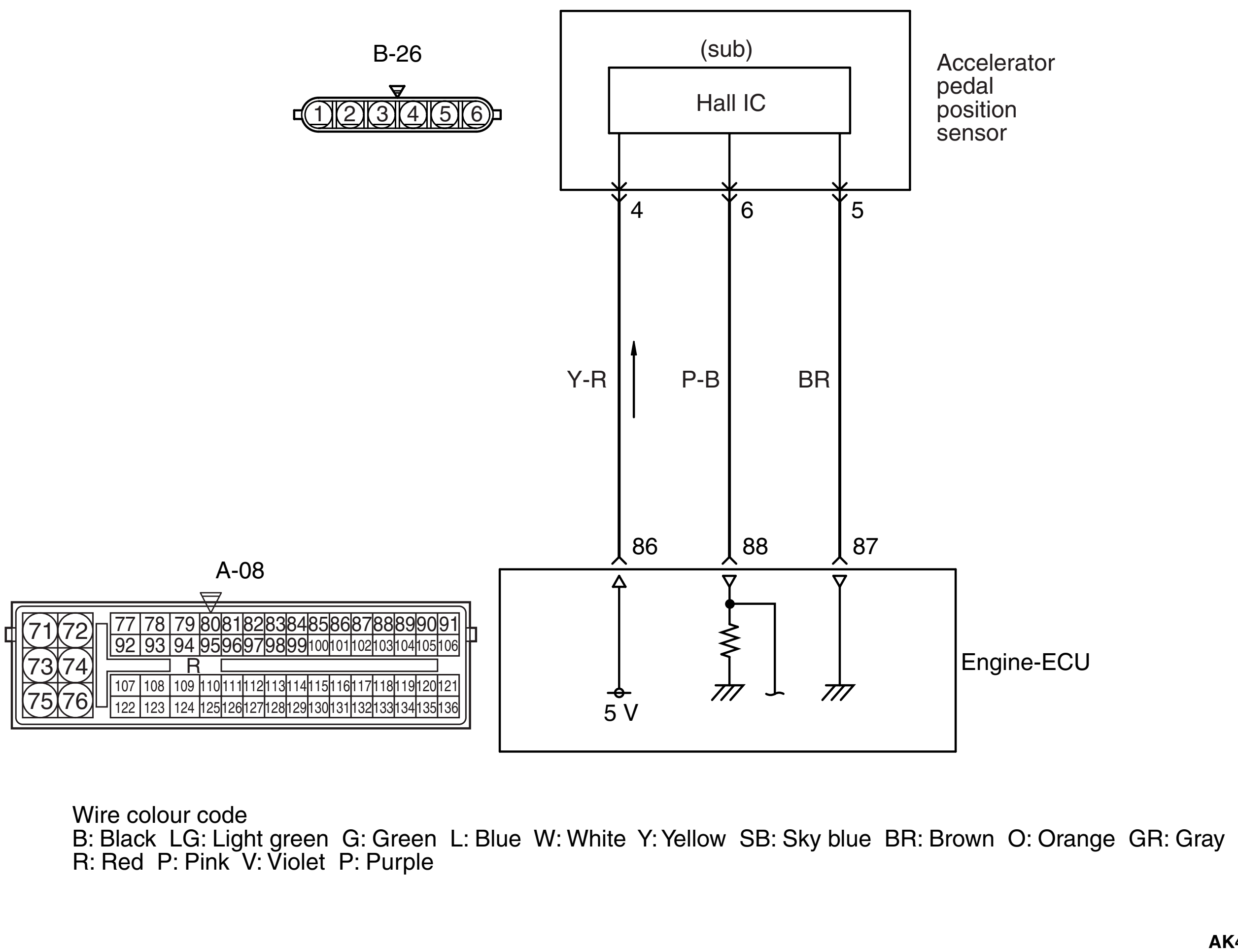
- After replacing the accelerator pedal assembly, re-check the trouble symptoms.

Q: Is the check result normal?

YES : Check end.
NO : Replace engine-ECU.

Code No. P2127: Accelerator Pedal Position Sensor (Sub) Circuit Low Input

Accelerator Pedal Position Sensor (sub) Circuit



OPERATION

- A power voltage of 5 V is applied to the accelerator pedal position sensor (terminal No. 4) from the engine-ECU (terminal No. 86).
- The power voltage is earthed to the engine-ECU (terminal No. 87) from the accelerator pedal position sensor (terminal No. 5).
- The sensor signal is inputted to the engine-ECU (terminal No. 88) from the accelerator pedal position sensor output terminal (terminal No. 6).

FUNCTION

- The accelerator pedal position sensor (sub) outputs voltage which corresponds to the accelerator pedal depression.
- The engine-ECU checks whether the voltage is within a specified range.

TROUBLE JUDGMENT

Check Condition

- Ignition switch is in "ON" position

Judgment Criterion

- Accelerator pedal position sensor (sub) output voltage is less than 0.2 V.

PROBABLE CAUSE

- Failed accelerator pedal position sensor
- Open/short circuit in accelerator pedal position sensor circuit or loose connector contact
- Failed engine-ECU

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DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list

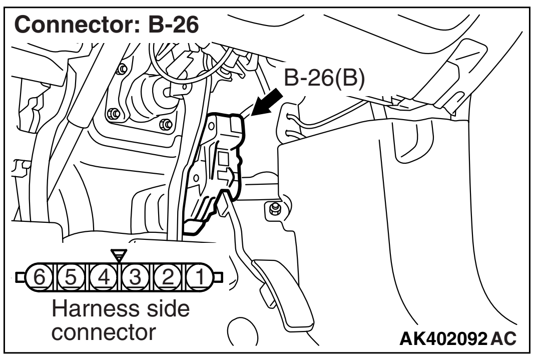
- Refer to Data List Reference Table P.13B-335.
  a. Item 77: Accelerator pedal position sensor (sub)

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

NO : Go to Step 2 .

STEP 2. Connector check: B-26 accelerator pedal position sensor connector

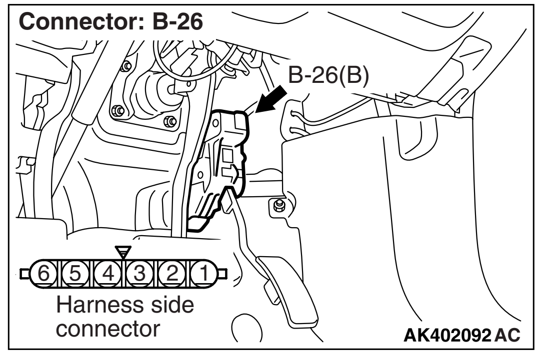


Q: Is the check result normal?

YES : Go to Step 3 .

NO : Repair or replace.

STEP 3. Perform voltage measurement at B-26 accelerator pedal position sensor connector.



- Disconnect connector, and measure at harness side.
- Ignition switch: ON
- Voltage between terminal No. 4 and earth.

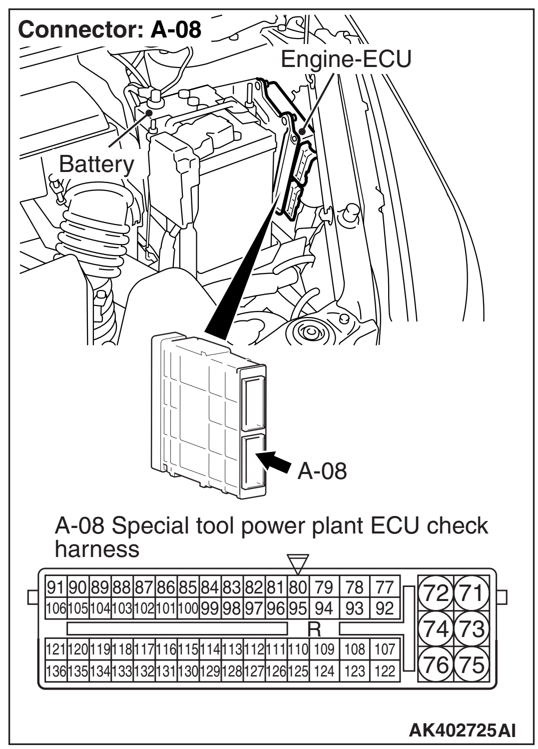
OK: 4.9 – 5.1 V

Q: Is the check result normal?

YES : Go to Step 7 .

NO : Go to Step 4 .

STEP 4. Connector check: A-08 engine-ECU connector



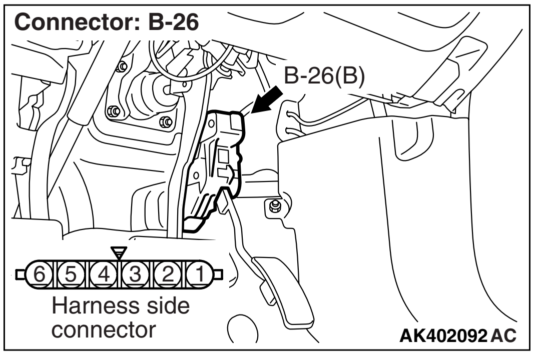
Q: Is the check result normal?

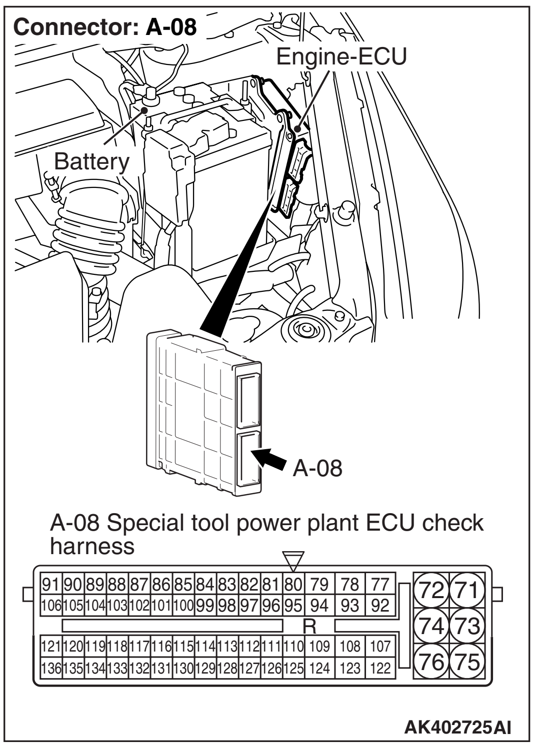
YES : Go to Step 5 .

NO : Repair or replace.

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STEP 5. Check harness between B-26 (terminal No. 4) accelerator pedal position sensor connector and A-08 (terminal No. 86) engine-ECU connector.





- Check power supply line for open/short circuit.

Q: Is the check result normal?

YES : Go to Step 6 .

NO : Repair.

STEP 6. M.U.T.-III data list

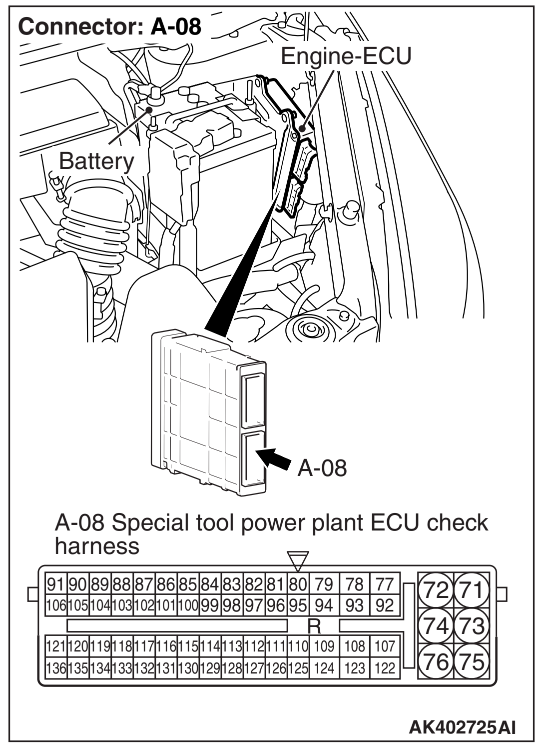
- Refer to Data List Reference Table P.13B-335.
  a. Item 77: Accelerator pedal position sensor (sub)

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

NO : Replace engine-ECU.

STEP 7. Connector check: A-08 engine-ECU connector

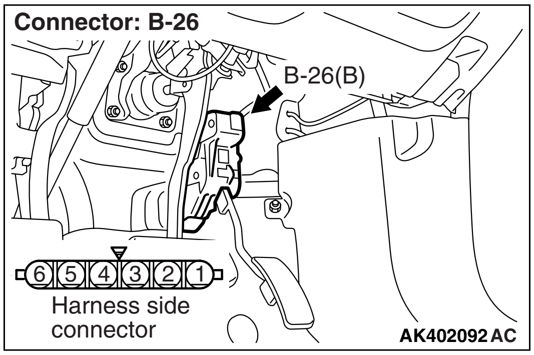


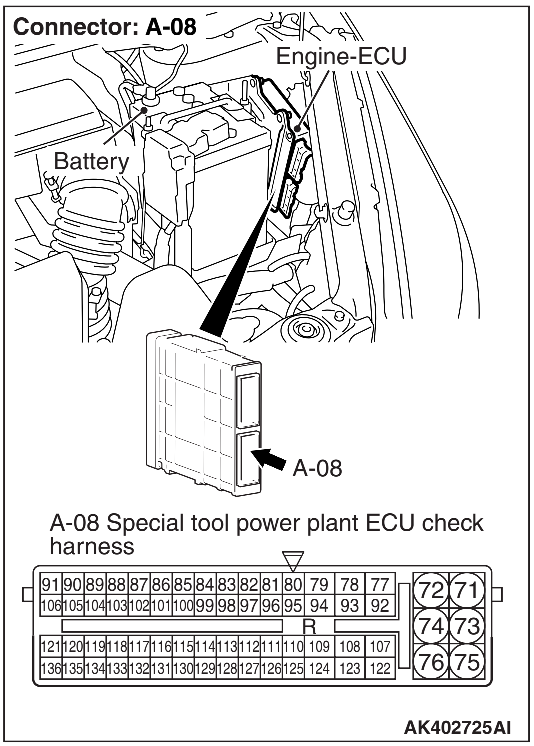
Q: Is the check result normal?

YES : Go to Step 8 .

NO : Repair or replace.

STEP 8. Check harness between B-26 (terminal No. 4) accelerator pedal position sensor connector and A-08 (terminal No. 86) engine-ECU connector.

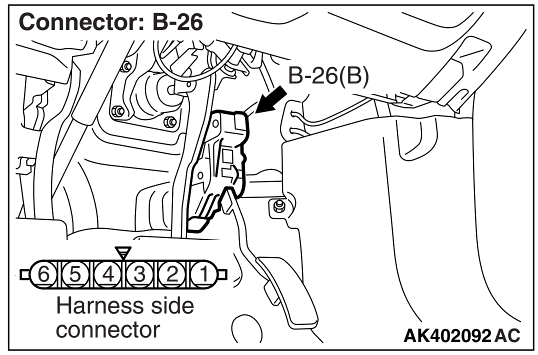


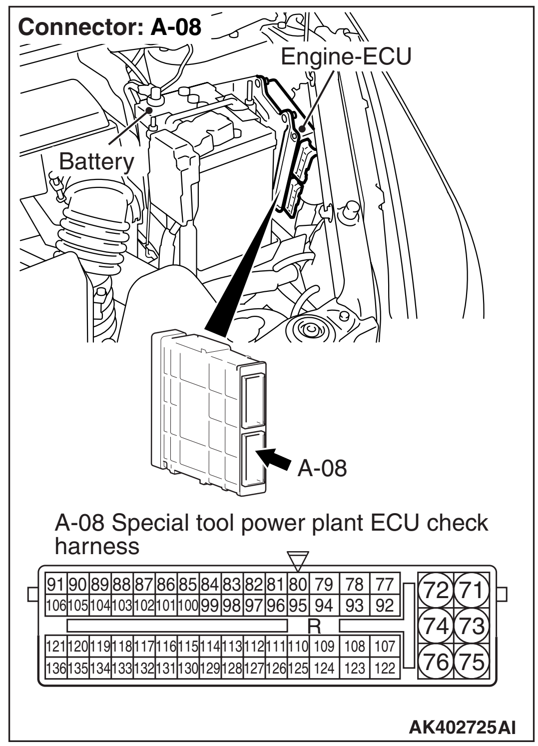


- Check power supply line for damage.

Q: Is the check result normal?
YES : Go to Step 9 .
NO : Repair.

STEP 9. Check harness between B-26 (terminal No. 6) accelerator pedal position sensor connector and A-08 (terminal No. 88) engine-ECU connector.





- Check output line for damage.

Q: Is the check result normal?
YES : Go to Step 10.
NO : Repair.

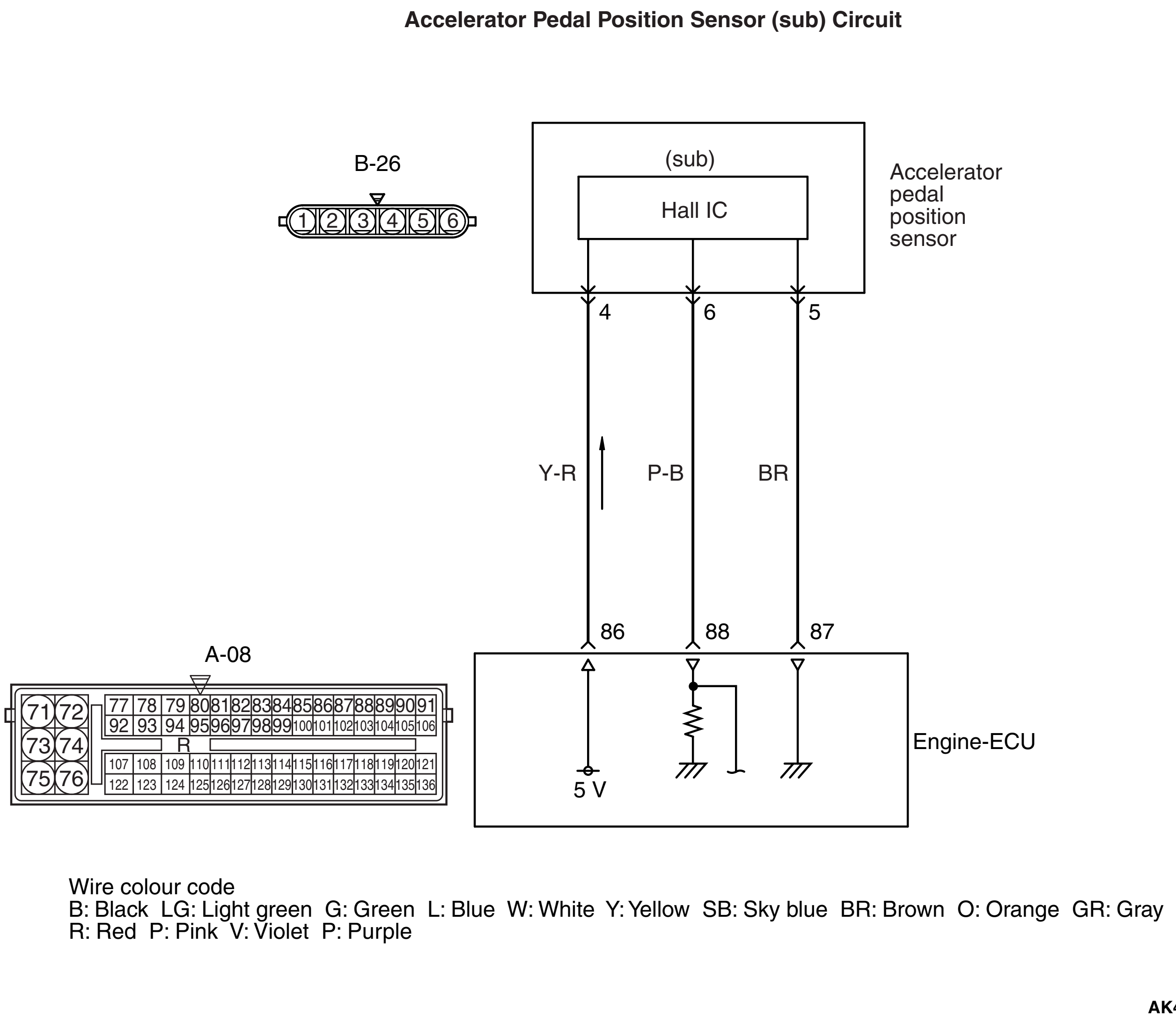
STEP 10. Replace the accelerator pedal assembly

- After replacing the accelerator pedal assembly, re-check the trouble symptoms.

Q: Is the check result normal?
YES : Check end.
NO : Replace engine-ECU.

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Code No. P2128: Accelerator Pedal Position Sensor (Sub) Circuit High Input



OPERATION

- A power voltage of 5 V is applied to the accelerator pedal position sensor (terminal No. 4) from the engine-ECU (terminal No. 86).
- The power voltage is earthed to the engine-ECU (terminal No. 87) from the accelerator pedal position sensor (terminal No. 5).
- The sensor signal is inputted to the engine-ECU (terminal No. 88) from the accelerator pedal position sensor output terminal (terminal No. 6).

FUNCTION

- The accelerator pedal position sensor (sub) outputs voltage which corresponds to the accelerator pedal depression.
- The engine-ECU checks whether the voltage is within a specified range.

TROUBLE JUDGMENT

Check Condition

- Ignition switch is in "ON" position.

Judgment Criterion

- Accelerator pedal position sensor (main) output voltage is more than 2.5 V.

PROBABLE CAUSE

- Failed accelerator pedal position sensor
- Open/short circuit in accelerator pedal position sensor circuit or loose connector contact
- Failed engine-ECU

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DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list

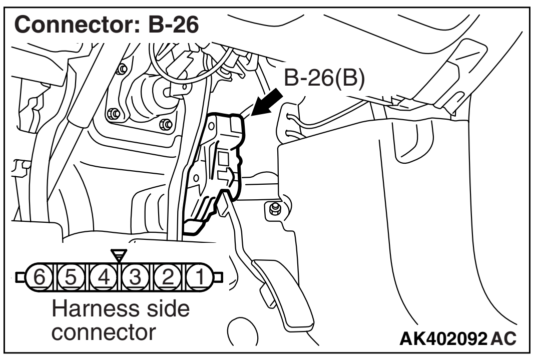
- Refer to Data List Reference Table P.13B-335.
  a. Item 77: Accelerator pedal position sensor (sub)

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

NO : Go to Step 2 .

STEP 2. Connector check: B-26 accelerator pedal position sensor connector

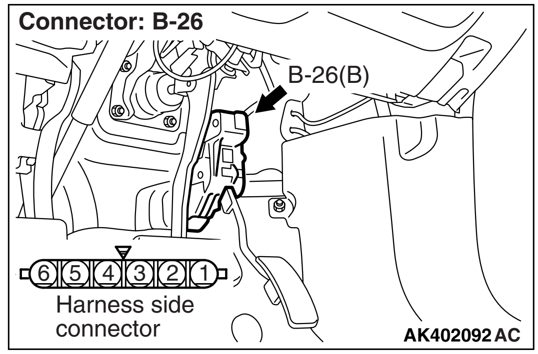


Q: Is the check result normal?

YES : Go to Step 3 .

NO : Repair or replace.

STEP 3. Perform resistance measurement at B-26 accelerator pedal position sensor connector.



- Disconnect connector, and measure at harness side.
- Resistance between terminal No. 5 and earth.

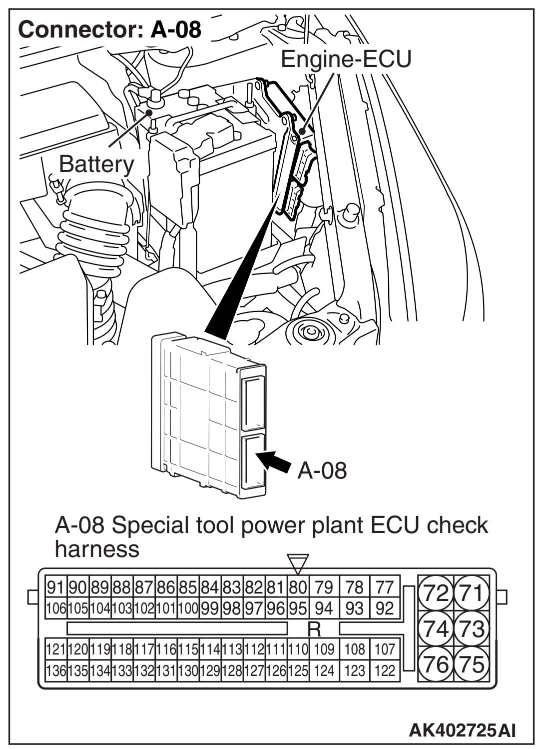
OK: Continuity (2 Ω or less)

Q: Is the check result normal?

YES : Go to Step 7 .

NO : Go to Step 4 .

STEP 4. Connector check: A-08 engine-ECU connector



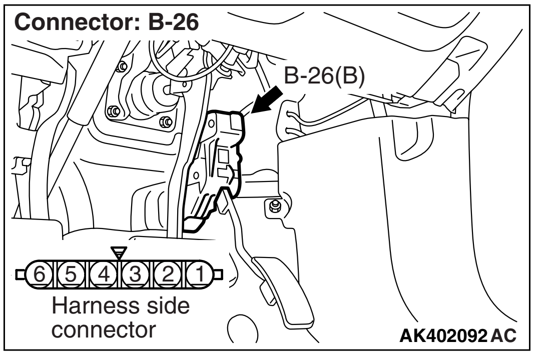
Q: Is the check result normal?

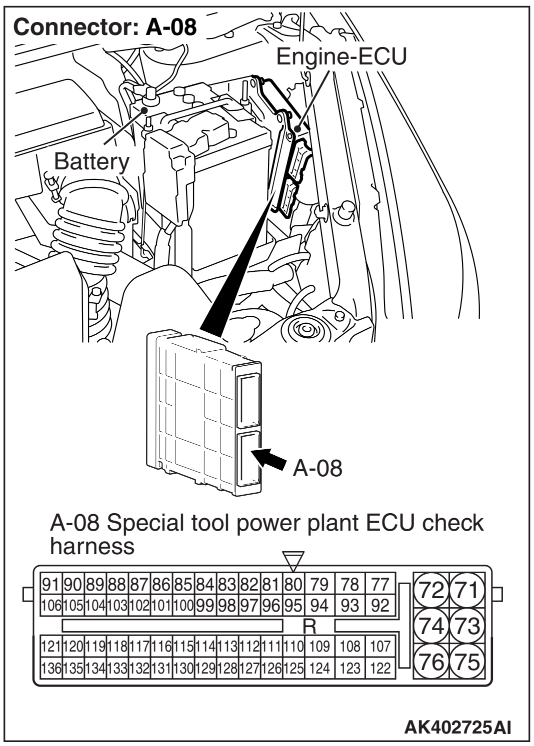
YES : Go to Step 5 .

NO : Repair or replace.

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STEP 5. Check harness between B-26 (terminal No. 5) accelerator pedal position sensor connector and A-08 (terminal No. 87) engine-ECU connector.





- Check earthing line for open circuit and damage.

Q: Is the check result normal?
YES : Go to Step 6 .
NO : Repair.

STEP 6. M.U.T.-III data list

- Refer to Data List Reference Table P.13B-335.
  a. Item 77: Accelerator pedal position sensor (sub)

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).
NO : Replace engine-ECU.

STEP 7. Replace the accelerator pedal assembly

- After replacing the accelerator pedal assembly, re-check the trouble symptoms.

Q: Is the check result normal?
YES : Check end.
NO : Replace engine-ECU.

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Code No. P2135: Throttle Position Sensor (Main and Sub) Range/Performance Problem

OPERATION

- Refer to Code No. P0122: Throttle Position Sensor (main) Circuit Low Input P.13B-53.
- Refer to Code No. P0222: Throttle Position Sensor (sub) Circuit Low Input P.13B-112.

FUNCTION

- Engine-ECU checks the throttle position sensor output signal characteristics for abnormal conditions.

TROUBLE JUDGMENT

Check Condition

- Ignition switch is in "ON" position.
- Throttle position sensor (main) output voltage is more than 0.2 V and is less than 4.8 V.
- Throttle position sensor (sub) output voltage is more than 0.2 V and is less than 4.8 V.

Judgment Criterion

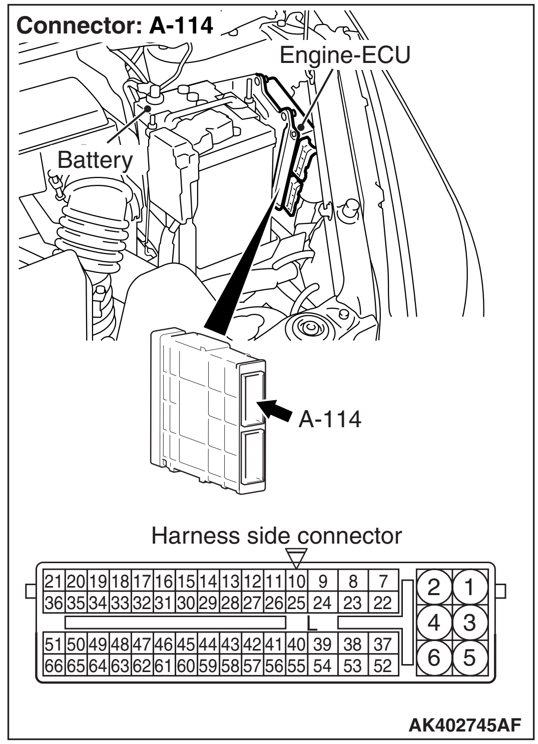
- Total output voltage of main and sub throttle position sensors is less than 4.5 V or is more than 5.5 V.

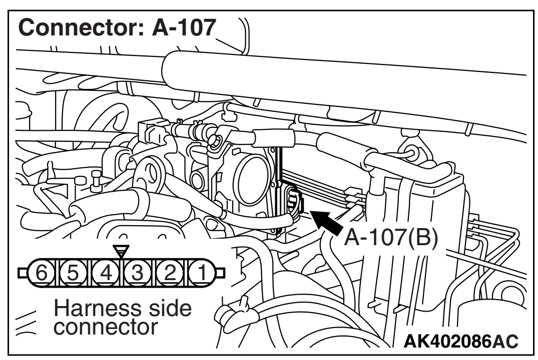
PROBABLE CAUSE

- Failed throttle position sensor
- Open/short circuit in throttle position sensor circuit or loose connector contact

DIAGNOSIS PROCEDURE

STEP 1. Connector check: A-114 engine-ECU connector and A-107 electronic-controlled throttle valve connector



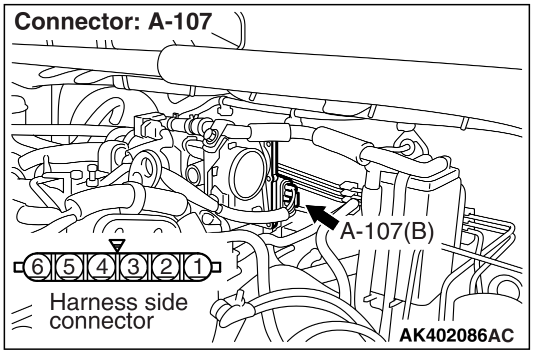


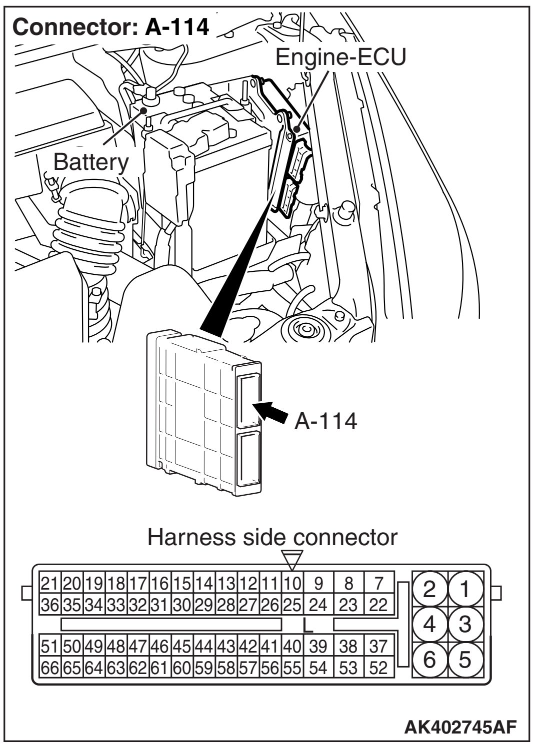
Q: Is the check result normal?

YES : Go to Step 2 .

NO : Repair or replace.

STEP 2. Check harness between A-107 (terminal No. 1) electronic-controlled throttle valve connector and A-114 (terminal No. 15) engine-ECU connector.





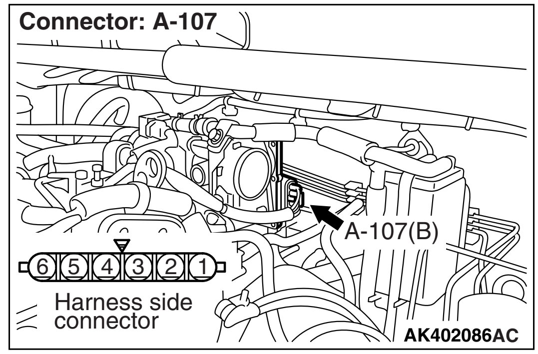
- Check output line for short circuit.

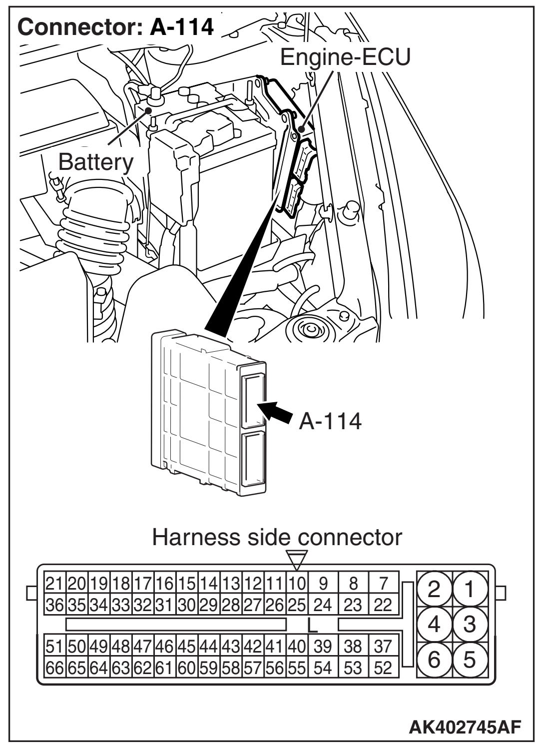
Q: Is the check result normal?

YES : Go to Step 3 .

NO : Repair.

STEP 3. Check harness between A-107 (terminal No. 3) electronic-controlled throttle valve connector and A-114 (terminal No. 16) engine-ECU connector.





- Check output line for short circuit.

Q: Is the check result normal?

YES : Go to Step 4 .

NO : Repair.

STEP 4. Replace throttle body assembly.

- After throttle body assembly is replaced, re-check for trouble symptom.

Q: Does trouble system persist?

YES : Replace engine-ECU.

NO : Check end.

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Code No. P2138: Accelerator Pedal Position Sensor (Main and Sub) Range/Performance Problem

OPERATION

- Refer to Code No. P2122: Accelerator Pedal Position Sensor (main) Circuit Low Input P.13B-212.
- Refer to Code No. P2127: Accelerator Pedal Position Sensor (sub) Circuit Low Input P.13B-220.

FUNCTION

- Engine-ECU checks the accelerator pedal position sensor output signal characteristics for abnormal conditions.

TROUBLE JUDGMENT

Check Conditions

- Ignition switch is in "ON" position.
- Not while engine is being cranked.
- Battery voltage is more than 6.3 V.
- Accelerator pedal position sensor (main) output voltage is more than 0.2 V and is less than 4.8 V.
- Accelerator pedal position sensor (sub) output voltage is more than 0.2 V and is less than 2.5 V.

Judgement Criterion

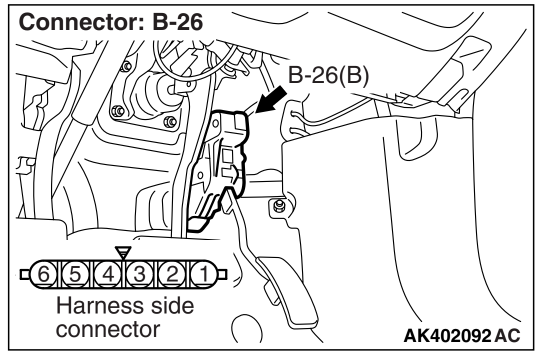
- When variation in accelerator openinging angle is small.
- Difference is more than 0.3 V between accelerator pedal position sensor (sub) output voltage multiplied by 2 and accelerator pedal position sensor (main) output voltage.

PROBABLE CAUSE

- Failed accelerator pedal position sensor
- Open/short circuit in accelerator pedal position sensor circuit or loose connector contact
- Failed engine-ECU

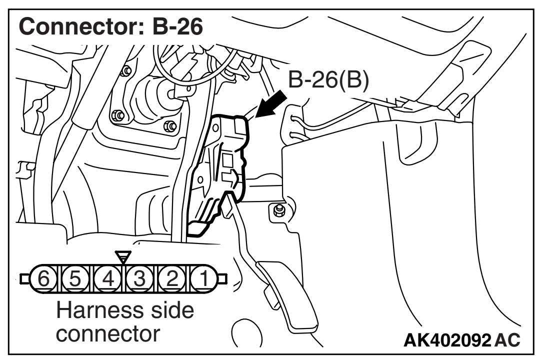
DIAGNOSIS PROCEDURE

STEP 1. Connector check: B-26 accelerator pedal position connector



Q: Is the check result normal?
YES : Go to Step 2 .
NO : Repair or replace.

STEP 2. Perform resistance measurement at B-26 accelerator pedal position sensor connector.



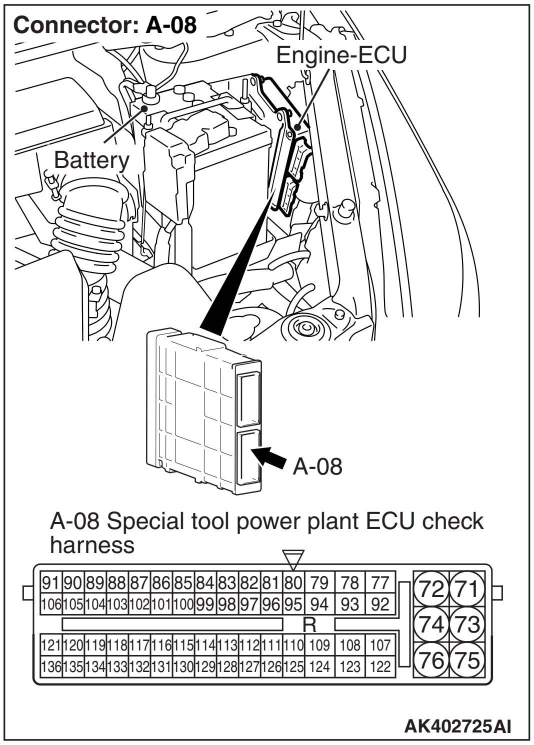
- Disconnect connector, and measure at harness side.
- Resistance between terminal No. 2 and earth.

OK: Continuity (2 Ω or less)

Q: Is the check result normal?
YES : Go to Step 6 .
NO : Go to Step 3 .

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STEP 3. Connector check: A-08 engine-ECU connector

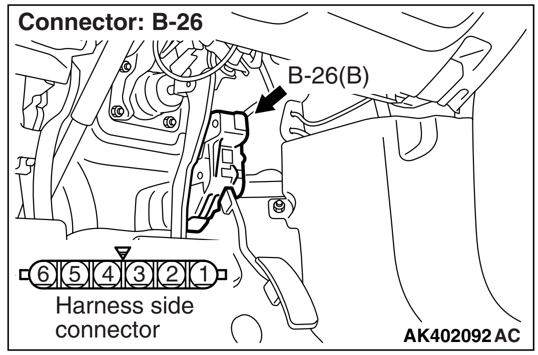


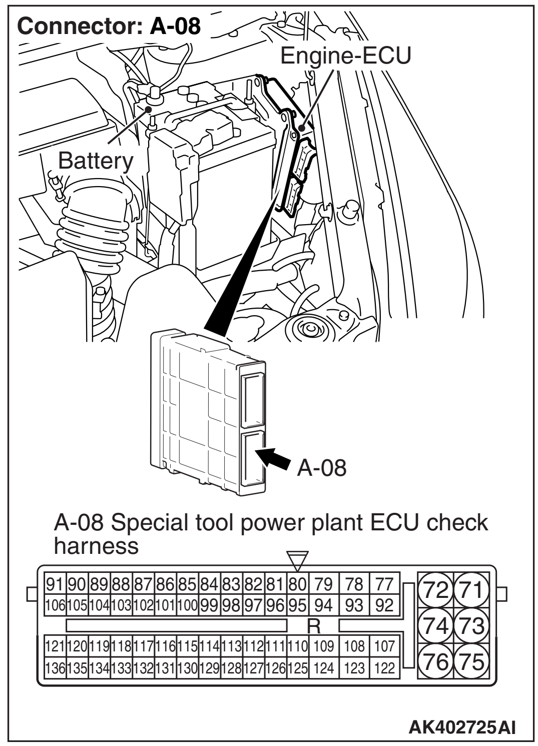
Q: Is the check result normal?

YES : Go to Step 4 .

NO : Repair or replace.

STEP 4. Check harness between B-26 (terminal No. 2) accelerator pedal position sensor connector and A-08 (terminal No. 84) engine-ECU connector.





- Check earthing line for damage.

Q: Is the check result normal?

YES : Go to Step 5 .

NO : Repair.

STEP 5. Check the trouble symptoms

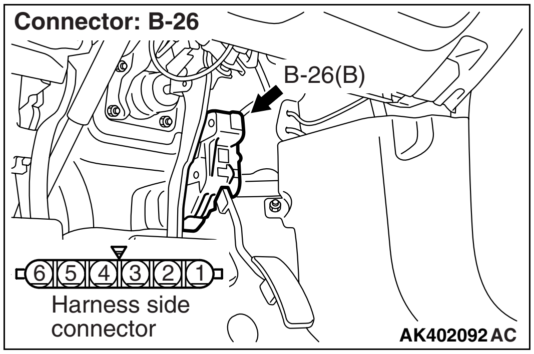
Q: Does trouble symptom persist?

YES : Replace engine-ECU.

NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

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STEP 6. Perform resistance measurement at B-26 accelerator pedal position sensor connector.



- Disconnect connector, and measure at harness side.
- Resistance between terminal No. 5 and earth.

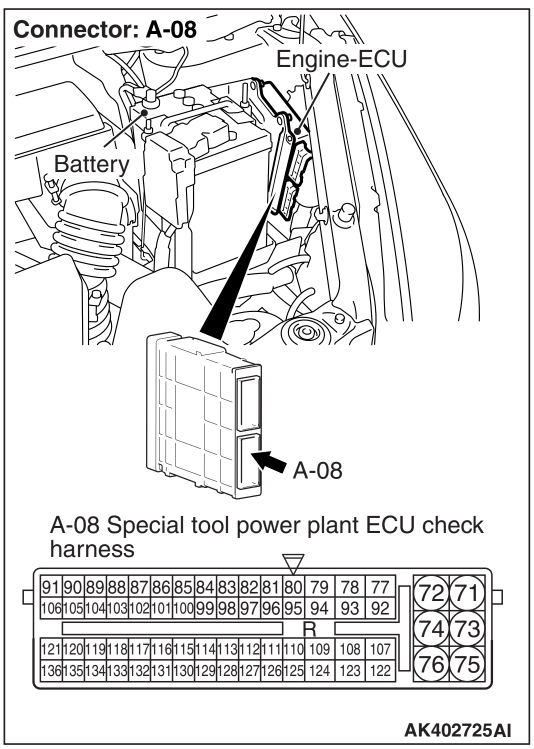
OK: Continuity (2 Ω or less)

Q: Is the check result normal?

YES : Go to Step 9 .

NO : Go to Step 7 .

STEP 7. Connector check: A-08 engine-ECU connector

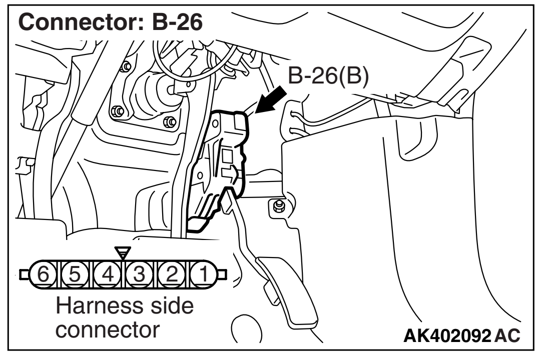


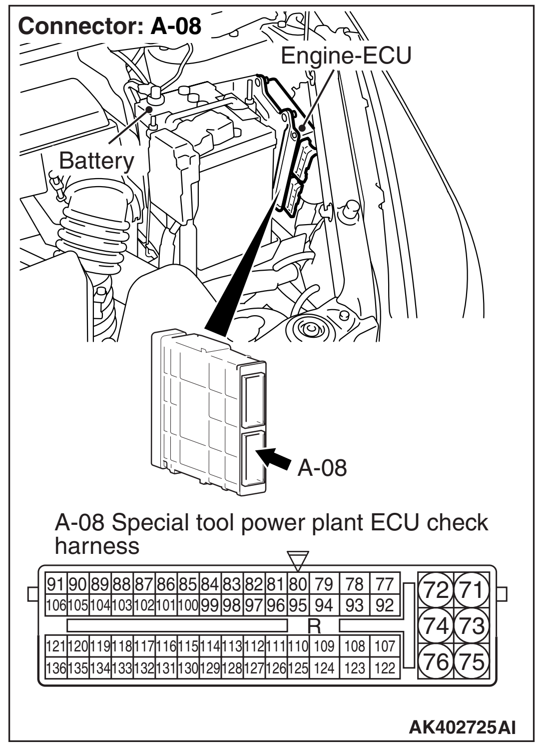
Q: Is the check result normal?

YES : Go to Step 8 .

NO : Repair or replace.

STEP 8. Check harness between B-26 (terminal No. 5) accelerator pedal position sensor connector and A-08 (terminal No. 87) engine-ECU connector.





- Check earthing line for damage.

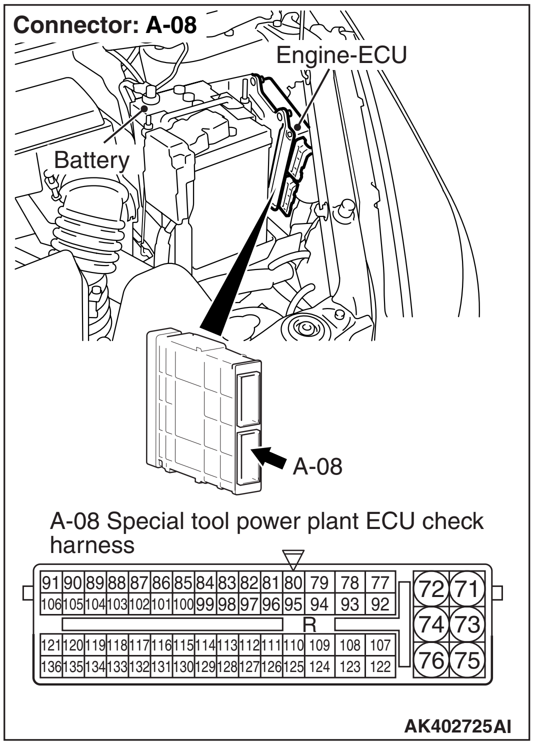
Q: Is the check result normal?

YES : Go to Step 5 .

NO : Repair.

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STEP 9. Connector check: A-08 engine-ECU connector

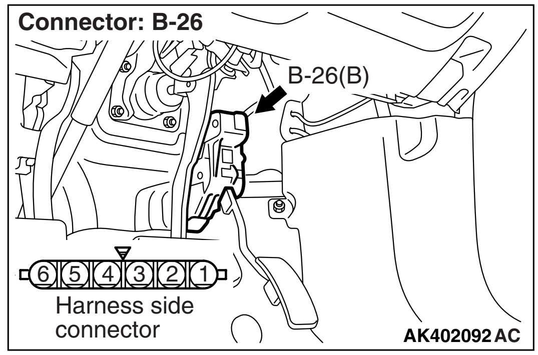


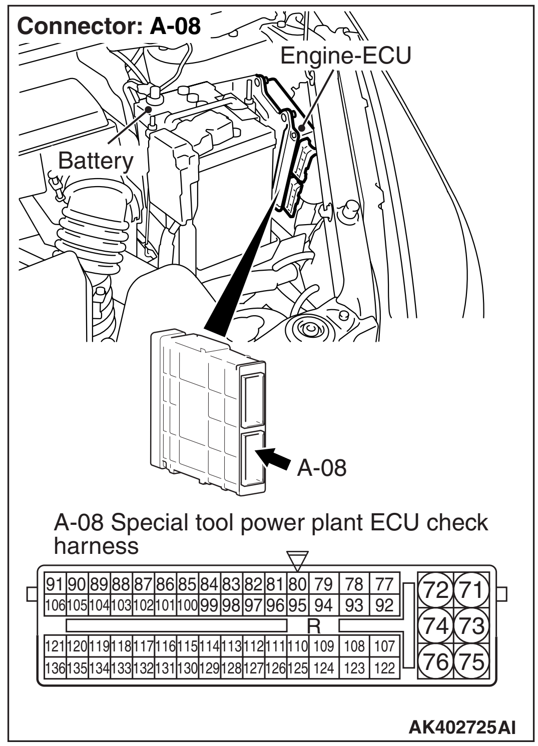
Q: Is the check result normal?

YES : Go to Step 10 .

NO : Repair or replace.

STEP 10. Check harness between B-26 (terminal No. 1) accelerator pedal position sensor connector and A-08 (terminal No. 85) engine-ECU connector.





- Check power supply line for damage.

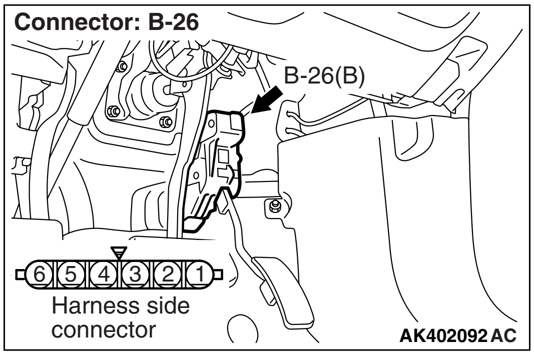
Q: Is the check result normal?

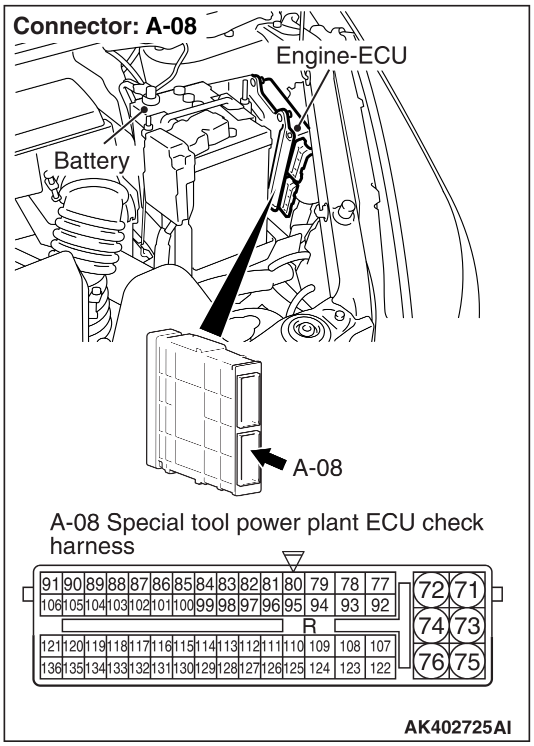
YES : Go to Step 11 .

NO : Repair.

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STEP 11. Check harness between B-26 (terminal No. 4) accelerator pedal position sensor connector and A-08 (terminal No. 86) engine-ECU connector.

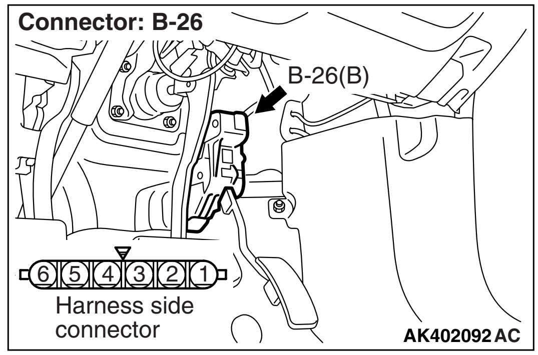


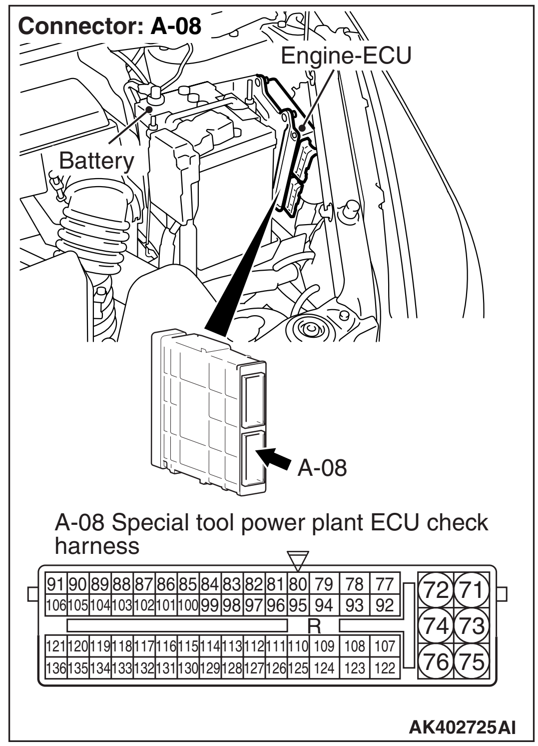


- Check power supply line for damage.

Q: Is the check result normal?
YES : Go to Step 12 .
NO : Repair.

STEP 12. Check harness between B-26 (terminal No. 3) accelerator pedal position sensor connector and A-08 (terminal No. 83) engine-ECU connector.

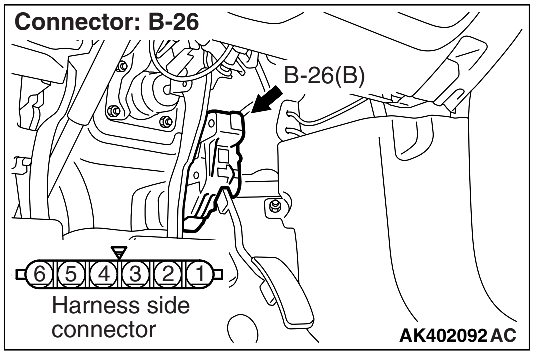


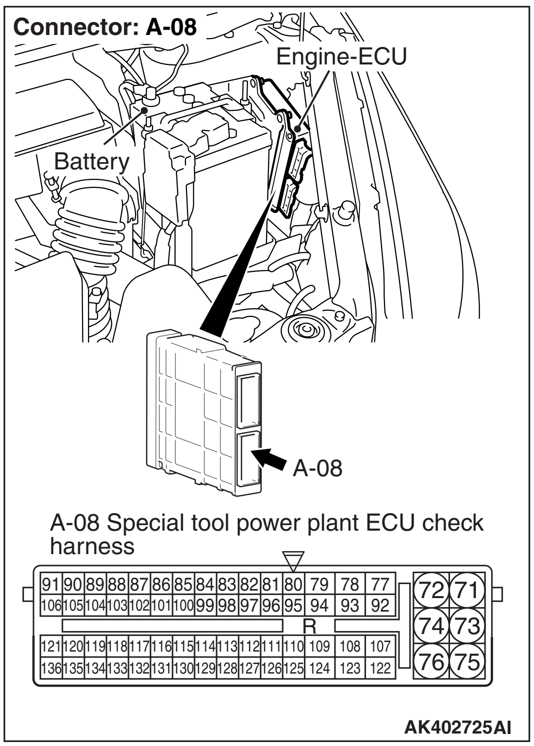


- Check output line for damage.

Q: Is the check result normal?
YES : Go to Step 13 .
NO : Repair.

STEP 13. Check harness between B-26 (terminal No. 6) accelerator pedal position sensor connector and A-08 (terminal No. 88) engine-ECU connector.





- Check output line for damage.

Q: Is the check result normal?
YES : Go to Step 14 .
NO : Repair.

STEP 14. Replace the accelerator pedal assembly

- After replacing the accelerator pedal assembly, re-check the trouble symptoms.

Q: Is the check result normal?
YES : Check end.
NO : Replace engine-ECU.

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Code No. U1073: Bus Off

⚠ CAUTION

Perform CAN bus-line diagnosis whenever the diagnosis code U1073 is set in the engine-ECU.

⚠ CAUTION

Replace the ECU only after confirming that the communication circuits are normal.

TROUBLE JUDGEMENT

Check Condition

- Ignition switch is in "ON" position.

Judgement Criterion

- When bus off error is detected.

COMMENT ON TROUBLE SYMPTOM

- Most possible causes are defects in CAN bus-line harnesses and connectors and malfunction of the engine-ECU.

PROBABLE CAUSES

- Failed harnesses and connectors
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III CAN bus diagnosis

- Using the M.U.T.-III, perform CAN busline diagnosis.

Q: Is the check result normal?

YES : Go to Step 2.

NO : Correct CAN busline (Refer to GROUP 54D – Troubleshooting – Can Bus Diagnosis Table P.54D-13). After repairing the CAN busline, go to Step 3.

STEP 2. M.U.T.-III diagnosis code

- Reconfirm whether the diagnosis code is output from engine-ECU.

1. Erase the diagnosis code being output.
2. Ignition switch: LOCK (OFF) to ON
3. Confirm whether the diagnosis code is output.

Q: Is the diagnosis code output?

YES : Replace engine-ECU, and then go to Step 3.

NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

STEP 3. M.U.T.-III diagnosis code

- Reconfirm whether the diagnosis code is output from engine-ECU.

1. Erase the diagnosis code being output.
2. Ignition switch: LOCK (OFF) to ON
3. Confirm whether the diagnosis code is output.

Q: Is the diagnosis code output?

YES : Go to Step 1.

NO : Check end.

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Code No. U1102: ABS-ECU Time-out

⚠ CAUTION
Perform CAN bus-line diagnosis whenever the diagnosis code U1102 is set in the engine-ECU.

⚠ CAUTION
Replace the ECU only after confirming that the communication circuits are normal.

TROUBLE JUDGEMENT

Check Conditions

- Ignition switch is in "ON" position.
- Battery voltage is more than 10 V.
- Cranking switch is in the OFF position or 3 seconds after turning the cranking switch from ON to OFF.

Judgement Criterion

- Signals from the ABS-ECU via the CAN bus-line cannot be received.

COMMENTS ON TROBLE SYMPTOMS

Current malfunction

- Most possible malfunctions are defects in CAN bus-line harnesses and connectors between the engine-ECU and ABS-ECU, malfunction in the ABS-ECU power supply system, or malfunction of the ABS-ECU or engine-ECU.

Past malfunction

- Focus on diagnosing malfunction of the harness and connector in CAN busline between engine-ECU and ABS-ECU as well as malfunction in the power supply system of ABS-ECU (Refer to GROUP 00 – How to use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

NOTE: In case of Past malfunction, M.U.T.-III CAN bus diagnosis cannot detect the failure even if there is malfunction in CAN bus, so that check CAN busline in the same way as Intermittent malfunction (Refer to GROUP 00 – How to use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13). The diagnosis codes being output to each ECU with CAN communication can narrow down the most suspected area. (Refer to GROUP 54D – Troubleshooting – CAN Bus Diagnosis Table P.54D-13).

PROBABLE CAUSES

- Failed harnesses and connectors in the CAN busline
- Failed ABS-ECU
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III CAN bus diagnosis

- Using M.U.T.-III, perform CAN busline diagnosis.

Q: Is the check result normal?

YES : Go to Step 2.
NO : Repair the CAN busline (Refer to GROUP 54D – Troubleshooting – CAN Bus Diagnosis Table P.54D-13). After repairing the CAN busline, go to Step 6.

STEP 2. M.U.T.-III other system diagnosis codes

- Confirm whether diagnosis codes are output from ABS-ECU.

Q: Is the diagnosis code output?

YES : Perform the troubleshooting of ABS. (Refer to GROUP 35B – Troubleshooting – Check Chart for Diagnosis Code P.35B-7).
NO : Go to Step 3.

STEP 3. M.U.T.-III other system diagnosis codes

Check whether the diagnosis code U1102: ABS-ECU time-out is output from the following ECU having CAN communication with ABS-ECU.

- EPS-ECU
- Meter-A/C-ECU

Q: Is the diagnosis code output?

YES : Go to Step 4.
NO : Go to Step 5.

STEP 4. M.U.T.-III diagnosis code

- Reconfirm whether the diagnosis code is output engine-ECU.

1. Erase the diagnosis code being output.
2. Ignition switch: LOCK (OFF) to ON
3. Confirm whether the diagnosis code is output.

Q: Is the diagnosis code output?

YES : Replace ABS-ECU, and then go to Step 6.
NO : Intermittent malfunction in the CAN busline between the engine-ECU and ABS-ECU (Refer to GROUP 00 – How to Cope with Intermittent Malfunctions P.00-13).

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STEP 5. M.U.T.-III diagnosis code

- Reconfirm whether the diagnosis code is output from engine-ECU.

1. Erase the diagnosis code being output.
2. Ignition switch: LOCK (OFF) to ON
3. Confirm whether the diagnosis code is output.

Q: Is the diagnosis code output?

YES : Replace engine-ECU, and then go to Step 6.

NO : Intermittent malfunction in the CAN busline between the engine-ECU and ABS-ECU (Refer to GROUP 00 – How to Cope with Intermittent Malfunctions P.00-13).

STEP 6. M.U.T.-III diagnosis code

- Reconfirm whether the diagnosis code is output from engine-ECU.

1. Erase the diagnosis code being output.
2. Ignition switch: LOCK (OFF) to ON
3. Confirm whether the diagnosis code is output.

Q: Is the diagnosis code output?

YES : Go to Step 1.

NO : Check end.

Code No. U1106: EPS-ECU Time-out

⚠ CAUTION

Perform the CAN bus-line diagnosis whenever the diagnosis code U1106 is set in the engine-ECU.

⚠ CAUTION

Replace the ECU only after confirming that the communication circuits are normal.

TROUBLE JUDGEMENT

Check Conditions

- Ignition switch is in "ON" position.
- Battery Voltage is more than 10 V.
- Cranking switch is in the OFF position or 3 seconds after turning the cranking from ON to OFF.

Judgement Criterion

- Signals from the EPS-ECU via the CAN bus-line cannot be received.

COMMENTS ON TROBLE SYMPTOMS

Current malfunction

- Most possible malfunctions are defects in CAN bus-line harnesses and connectors between the engine-ECU and ESP-ECU, malfunction in the ESP-ECU power supply system, or malfunction of the ESP-ECU or engine-ECU.

Past malfunction

- Focus on diagnosing that the harness and the connector have malfunction in the CAN busline between the engine-ECU and the EPS-ECU, or the power supply system in the EPS-ECU has malfunction. The diagnosis procedure is referred to strategy for Intermittent malfunction (Refer to GROUP00 – How to use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

NOTE: In the case of the previous malfunction, malfunction cannot be found through the diagnose of M.U.T.-III – CAN busline even if the CAN busline has malfunction; therefore check for the CAN busline in the same way as Intermittent malfunction (Refer to GROUP00 – How to use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13). By the diagnosis code, which is output to the ECU where the CAN communication is performed, can narrow down the area to the most suspected place P.54D-13).

PROBABLE CAUSES

- Failed harnesses and connectors in the CAN busline
- Failed EPS-ECU
- Failed engine-ECU

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DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III CAN bus diagnosis

- Using M.U.T.-III, perform CAN busline diagnosis.

Q: Is the check result normal?

YES : Go to Step 2.

NO : Repair the CAN busline (Refer to GROUP 54D – Troubleshooting – CAN Bus Diagnosis Table P.54D-13). After repairing the CAN busline, go to Step 6.

STEP 2. M.U.T.-III other system diagnosis codes

- Check whether diagnosis code is output from ESP-ECU.

Q: Is the diagnosis code output?

YES : Carry out troubleshooting of the EPS (Refer to GROUP 37 – Troubleshooting – Check Chart for Diagnosis codes P.37-9).

NO : Go to Step 3.

STEP 3. M.U.T.-III other system diagnosis codes

Check whether the diagnosis code U1106: EPS-ECU time-out is set in the following ECU that are communicating with the EPS-ECU via the CAN bus.

- Meter-A/C-ECU

Q: Is the diagnosis code output?

YES : Go to Step 4.

NO : Go to Step 5.

STEP 4. M.U.T.-III diagnosis code

- Reconfirm whether the diagnosis code is output from engine-ECU.

1. Erase the diagnosis code being output.
2. Ignition switch: LOCK (OFF) to ON
3. Confirm whether the diagnosis code is output.

Q: Is the diagnosis code output?

YES : Replace EPS-ECU, and then go to Step 6.

NO : Intermittent malfunction in the CAN busline between the engine-ECU and EPS-ECU (Refer to GROUP 00 – How to use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

STEP 5. M.U.T.-III diagnosis code

- Reconfirm whether the diagnosis code is output from engine-ECU.

1. Erase the diagnosis code being output.
2. Ignition switch: LOCK (OFF) to ON
3. Confirm whether the diagnosis code is output.

Q: Is the diagnosis code output?

YES : Replace engine-ECU, and then go to Step 6.

NO : Intermittent malfunction in the CAN busline between the engine-ECU and EPS-ECU (Refer to GROUP 00 – How to use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

STEP 6. M.U.T.-III diagnosis code

Reconfirm whether the diagnosis code is output from engine-ECU.

1. Erase the diagnosis code being output.
2. Ignition switch: LOCK (OFF) to ON
3. Confirm whether the diagnosis code is output.

Q: Is the diagnosis code output?

YES : Go to Step 1.

NO : Check end.

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Code No. U1108: Combination Meter Time-out

⚠ CAUTION
Perform CAN bus-line diagnosis whenever the diagnosis code U1108 is set in the engine-ECU.

⚠ CAUTION
Replace the ECU only after confirming that the communication circuits are normal.

TROUBLE JUDGEMENT

Check Conditions

- Ignition switch is in "ON" position.
- Battery Voltage is more than 10 V.
- Cranking switch is in the OFF position or 3 seconds after turning the cranking switch from ON to OFF.

Judgement Criterion

- Signals from the meter-A/C-ECU via the CAN bus-line cannot be received.

COMMENTS ON TROBLE SYMPTOMS

Current malfunction

- Most possible malfunctions are defects in CAN bus-line harnesses and connectors between the engine-ECU and meter-A/C-ECU, malfunction in the meter-A/C-ECU power supply system, or malfunction of the meter-A/C-ECU or engine-ECU.

Past malfunction

- Focus on diagnosing malfunction of the harness and connector in CAN busline between engine-ECU and combination meter as well as malfunction in the power supply system of combination meter (Refer to GROUP 00 – How to use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

NOTE: In case of Past malfunction, M.U.T.-III CAN bus diagnosis cannot detect the failure even if there is malfunction in CAN bus, so that check CAN busline in the same way as Intermittent malfunction (Refer to GROUP 00 – How to use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13). The diagnosis codes being output to each ECU with CAN communication can narrow down the most suspected area (Refer to GROUP 54D – Troubleshooting – CAN Bus Diagnosis Table P.54D-13).

PROBABLE CAUSES

- Failed harnesses and connectors
- Failed meter-A/C-ECU
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III CAN bus diagnosis

- Using M.U.T.-III, perform CAN busline diagnosis.

Q: Is the check result normal?
YES : Go to Step 2.
NO : Repair the CAN busline (Refer to GROUP 54D – Troubleshooting – CAN Bus Diagnosis Table P.54D-13). After repairing the CAN busline, go to Step 6.

STEP 2. M.U.T.-III other system diagnosis codes

- Check whether diagnosis codes is output from meter-A/C-ECU.

Q: Is the diagnosis code output?
YES : Perform troubleshooting of the combination meter (Refer to GROUP 54A – Troubleshooting – Check Chart for Diagnosis Codes P.54A-31).
NO : Go to Step 3.

STEP 3. M.U.T.-III other system diagnosis codes

Check whether the diagnosis code U1108: A/C-ECU time-out is output from the following ECU having CAN communication with the meter-A/C-ECU.

- ETACS-ECU

Q: Is the diagnosis code output?
YES : Go to Step 4.
NO : Go to Step 5.

STEP 4. M.U.T.-III diagnosis code

- Reconfirm whether the diagnosis code is output from engine-ECU.

1. Erase the diagnosis code being output.
2. Ignition switch: LOCK (OFF) to ON
3. Confirm whether the diagnosis code is output.

Q: Is the diagnosis code output?
YES : Replace meter-A/C-ECU, and then go to Step 6.
NO : Intermittent malfunction in the CAN busline between the engine-ECU and meter-A/C-ECU (Refer to GROUP 00 – How to use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

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STEP 5. M.U.T.-III diagnosis code

- Reconfirm whether the diagnosis code is output from engine-ECU.

1. Erase the diagnosis code being output.
2. Ignition switch: LOCK (OFF) to ON
3. Confirm whether the diagnosis code is output.

Q: Is the diagnosis code output?

YES : Replace engine-ECU, and then go to Step 6.

NO : Intermittent malfunction in the CAN busline between the engine-ECU and meter-A/C-ECU (Refer to GROUP 00 – How to use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

STEP 6. M.U.T.-III diagnosis code

- Reconfirm whether the diagnosis code is output from engine-ECU.

1. Erase the diagnosis code being output.
2. Ignition switch: LOCK (OFF) to ON
3. Confirm whether the diagnosis code is output.

Q: Is the diagnosis code output?

YES : Go to Step 1.

NO : Check end.

Code No. U1110: A/C-ECU Time-out

⚠ CAUTION

Perform CAN bus-line diagnosis whenever the diagnosis code U1110 is set in the engine-ECU.

⚠ CAUTION

Replace the ECU only after confirming that the communication circuits are normal.

TROUBLE JUDGEMENT

Check Conditions

- Ignition switch is in "ON" position.
- Battery Voltage is more than 10 V.
- Cranking switch is in the OFF position or 3 seconds after turning the cranking switch from ON to OFF.

Judgement Criterion

- Signals from the meter-A/C-ECU via the CAN bus-line cannot be received.

COMMENTS ON TROBLE SYMPTOMS

Current malfunction

- Most possible malfunctions are defects in CAN bus-line harnesses and connectors between the engine-ECU and meter-A/C-ECU, malfunction in the meter-A/C-ECU power supply system, or malfunction of the meter-A/C-ECU or engine-ECU.

Past malfunction

- Focus on diagnosing malfunction of the harness and connector in CAN busline between engine-ECU and A/C-ECU as well as malfunction in the power supply system of A/C-ECU (Refer to GROUP 00 – How to use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

NOTE: In case of Past malfunction, M.U.T.-III CAN bus diagnosis cannot detect the failure even if there is malfunction in CAN bus, so that check CAN busline in the same way as Intermittent malfunction (Refer to GROUP 00 – How to use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13). The diagnosis codes being output to each ECU with CAN communication can narrow down the most suspected area (Refer to GROUP 54D – Troubleshooting – CAN Bus Diagnosis Table P.54D-13).

PROBABLE CAUSES

- Failed harnesses and connectors
- Failed meter-A/C-ECU
- Failed engine-ECU

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DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III CAN bus diagnosis

- Using M.U.T.-III, perform CAN busline diagnosis.

Q: Is the check result normal?

YES : Go to Step 2.
NO : Repair the CAN busline (Refer to GROUP 54D – Troubleshooting – CAN Bus Diagnosis Table P.54D-13). After repairing the CAN busline, go to Step 6.

STEP 2. M.U.T.-III other system diagnosis codes

- Check whether diagnosis codes is output from meter-A/C-ECU.

Q: Is the diagnosis code output?

YES : Perform troubleshooting of the air conditioning system (Refer to GROUP 55B –Troubleshooting P.55B-3).
NO : Go to Step 3.

STEP 3. M.U.T.-III other system diagnosis codes

Check whether the diagnosis code U1110: A/C-ECU time-out is output from the following ECU having CAN communication with meter-A/C-ECU.

- ETACS-ECU

Q: Is the diagnosis code output?

YES : Go to Step 4.
NO : Go to Step 5.

STEP 4. M.U.T.-III diagnosis code

Reconfirm whether the diagnosis code is output from engine-ECU.

1. Erase the diagnosis code being output.
2. Ignition switch: LOCK (OFF) to ON
3. Confirm whether the diagnosis code is output.

Q: Is the diagnosis code output?

YES : Replace the A/C-ECU, and then go to Step 6.
NO : Intermittent malfunction in the CAN bus-line between the engine-ECU and meter-A/C-ECU (Refer to GROUP 00 – How to use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

STEP 5. M.U.T.-III diagnosis code

- Reconfirm whether the diagnosis code is output from engine-ECU.

1. Erase the diagnosis code being output.
2. Ignition switch: LOCK (OFF) to ON
3. Confirm whether the diagnosis code is output.

Q: Is the diagnosis code output?

YES : Replace engine-ECU, and then go to Step 6.
NO : Intermittent malfunction in the CAN bus-line between the engine-ECU and meter-A/C-ECU (Refer to GROUP 00 – How to use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

STEP 6. M.U.T.-III diagnosis code

- Reconfirm whether the diagnosis code is output from engine-ECU.

1. Erase the diagnosis code being output.
2. Ignition switch: LOCK (OFF) to ON
3. Confirm whether the diagnosis code is output.

Q: Is the diagnosis code output?

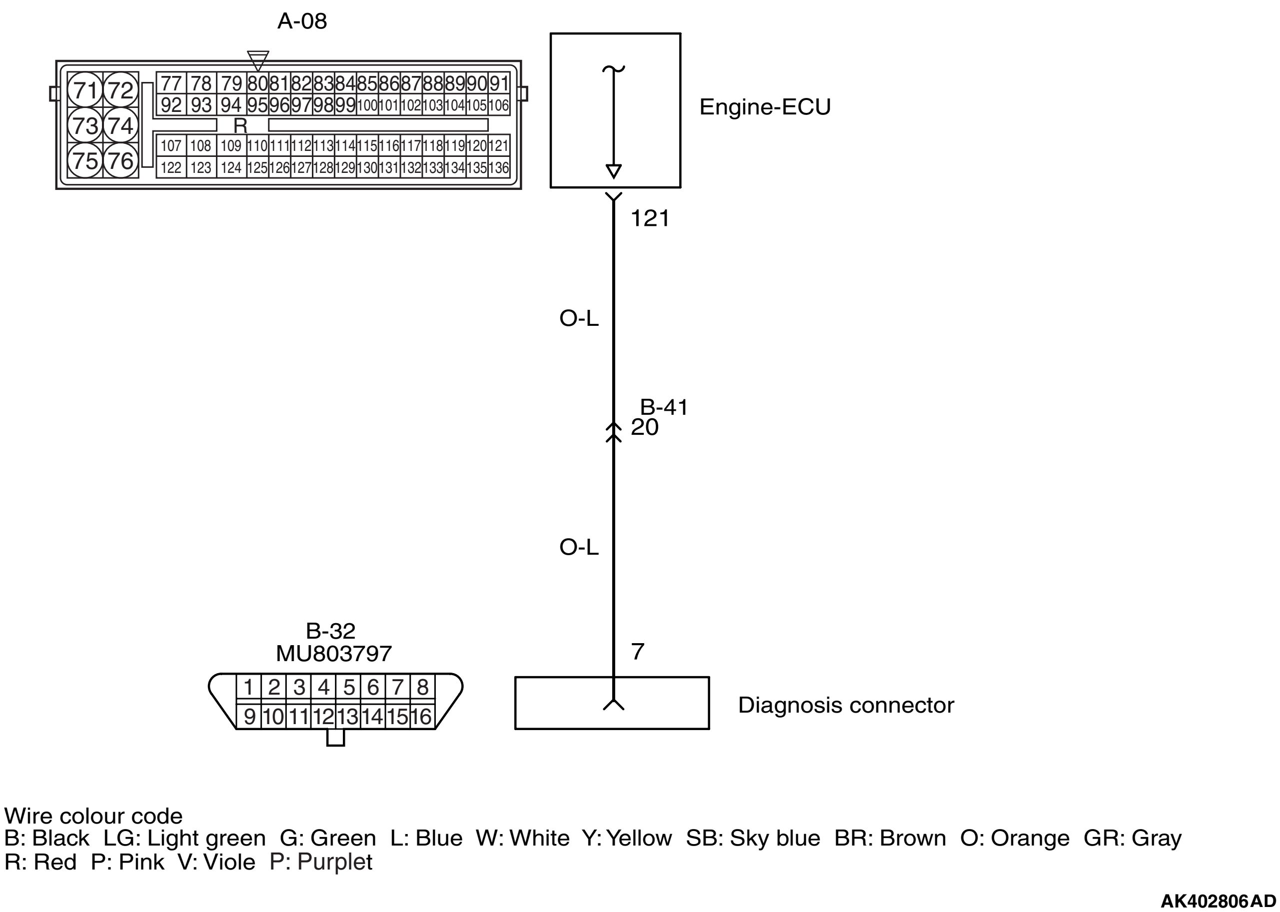
YES : Go to Step 1.
NO : Check end.

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SYMPTOM PROCEDURES

Inspection Procedure 1: Communication with Engine-ECU is Not Possible

Diagnosis Connector Circuit



OPERATION

- Data is communicated between diagnosis connector output terminal (terminal No. 7) and engine-ECU (terminal No. 121).

COMMENT ON TROUBLE SYMPTOM

- The problem may probably be traced to engine-ECU power circuit or earth circuit.

PROBABLE CAUSES

- Open/short circuit in or damage to the engine-ECU power circuit
- Between engine-ECU and diagnosis connector for open/short circuit or damage
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Check engine start.

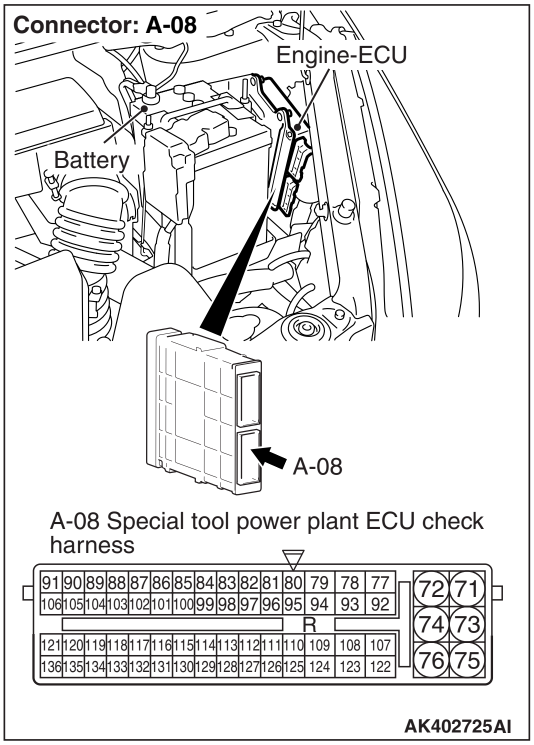
Q: Does engine start?

YES : Go to Step 2 .

NO : Check engine-ECU power source, engine control relay, and ignition switch-IG1 system (Refer to Inspection Procedure 21 P.13B-282).

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STEP 2. Connector check: A-08 engine-ECU connector

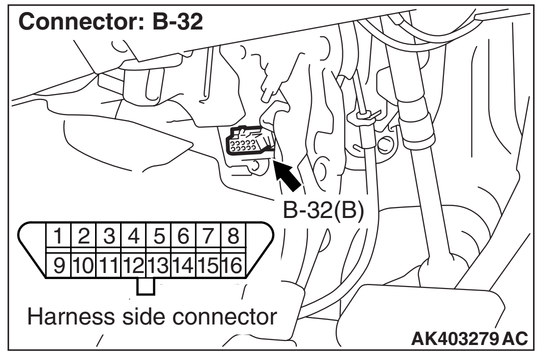


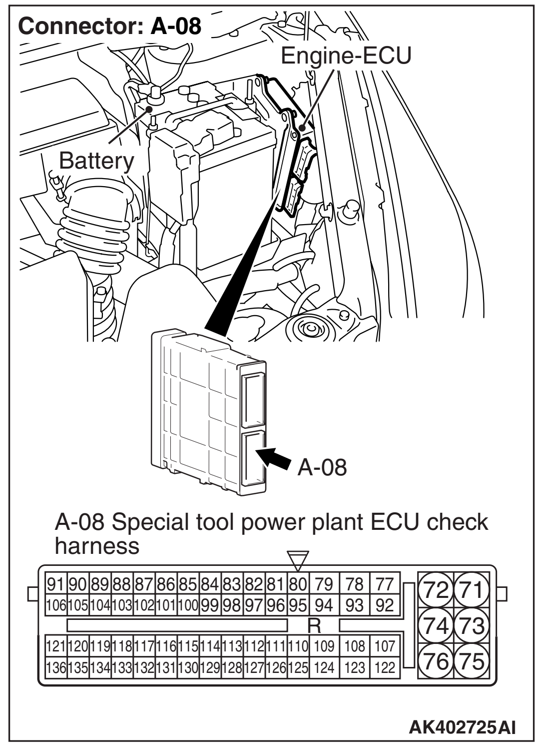
Q: Is the check result normal?

YES : Go to Step 3 .

NO : Repair or replace.

STEP 3. Check harness between B-32 (terminal No. 7) diagnosis connector and A-08 (terminal No. 121) engine-ECU connector.





NOTE: Before checking harness, check intermediate connector B-41 and repair if necessary.

- Check signal line for open/short circuit or damage.

Q: Is the check result normal?

YES : Go to Step 4 .

NO : Repair.

STEP 4. Check the trouble symptom.

Q: Does trouble symptom recur?

YES : Replace engine-ECU.

NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

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Inspection Procedure 2: The Engine Warning Lamp Does Not Illuminate Right after the Ignition Switch is Turned to the "ON" Position

COMMENT ON TROUBLE SYMPTOM

- On the combination meter, engine warning lamp illuminates for 5 seconds right after ignition switch is turned ON.
- If engine warning lamp does not illuminate right after ignition switch is turned ON, the failure is possibly caused by malfunction of engine warning lamp, open or short in the combination meter circuits and so on.

PROBABLE CAUSES

- Failed engine warning lamp
- Open/short circuit in combination meter

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

Q: Is the diagnosis code output?

YES : Inspection chart for diagnosis codes (Refer to P.13B-18).

NO : Go to Step 2 .

STEP 2. Check the trouble symptoms.

Q: Does trouble system persist?

YES : Replace combination meter assembly.

NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

Inspection Procedure 3: The Engine Warning Lamp Remains Illuminating and Never Goes Out

COMMENT ON TROUBLE SYMPTOM

- Engine-ECU has possibly detected the problem. Probable causes include combination meter circuit being shorted.

PROBABLE CAUSE

- Short circuit in combination meter

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

Q: Is the diagnosis code output?

YES : Inspection chart for diagnosis codes (Refer to P.13B-18).

NO : Go to Step 2 .

STEP 2. Check the trouble symptoms.

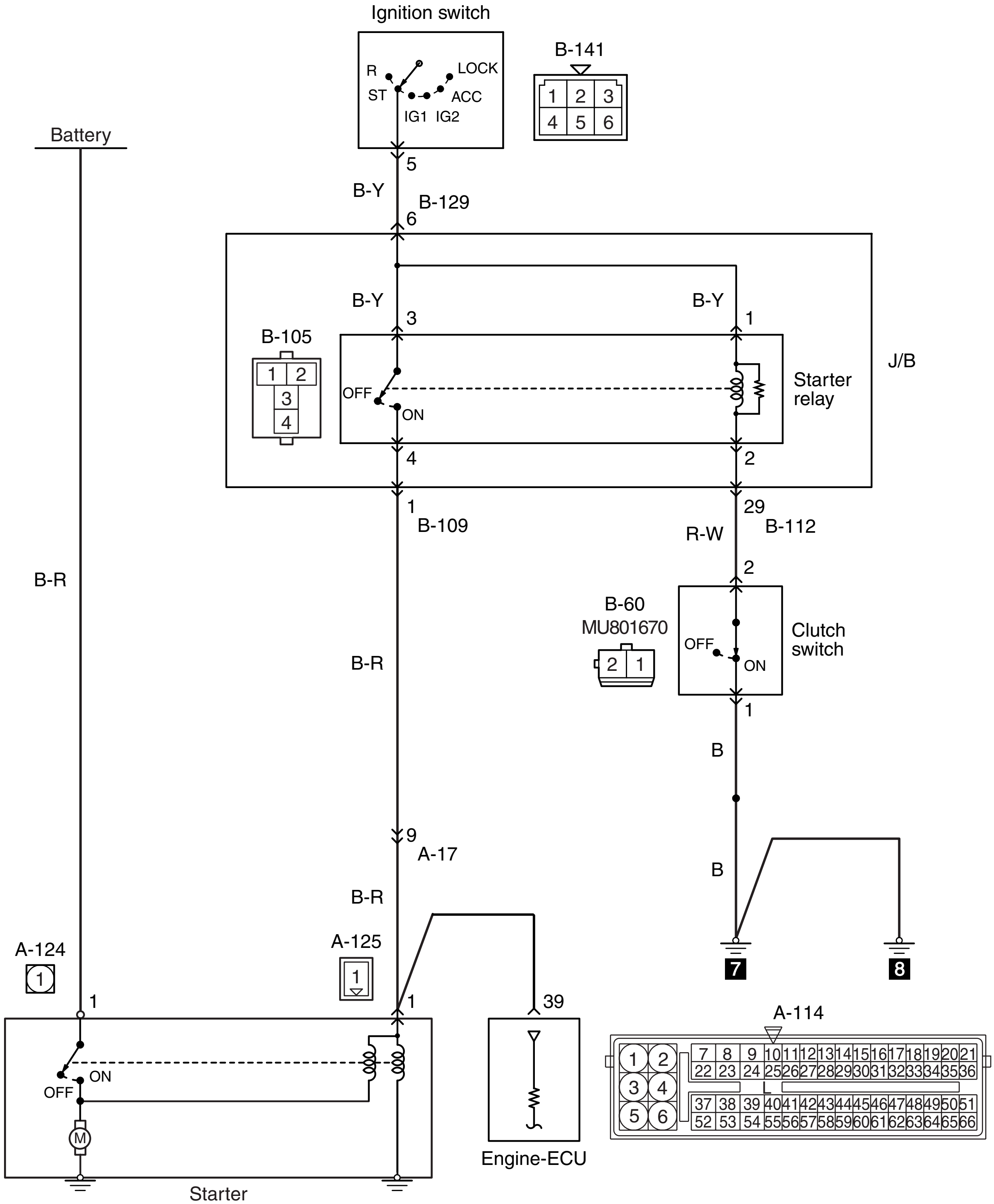
Q: Does trouble system persist?

YES : Replace combination meter assembly.

NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

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Inspection Procedure 4: Starting Impossible (No Initial Combustion)



Wire colour code
B: Black LG: Light green G: Green L: Blue W: White Y: Yellow SB: Sky blue BR: Brown O: Orange GR: Gray
R: Red P: Pink V: Violet Pu: Purple

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OPERATION

- When the ignition switch is turned to the "START" position and the clutch switch is in ON position (the clutch is depressed), the starter relay turns on.
- If the ignition switch is turned to "START" position, battery voltage is applied to the starter (Terminal No.1) through the starter relay.
- If the ignition switch is tuned to "START" position battery voltage is applied to engine-ECU (terminal No.39) from ignition switch. Because of this, engine ECU detects that the engine is cranked.

COMMENT ON TROUBLE SYMPTOM

- Failure is possibly caused by failed starter itself or failed related circuit.

PROBABLE CAUSE

- Failed battery
- Failed starter motor
- Open/short circuit in starter associated circuit or loose connector contact

DIAGNOSIS PROCEDURE

STEP 1. Check battery voltage.

- Measure battery voltage at cranking.

OK: 8 V or higher

Q: Is the check result normal?

YES : Go to Step 2 .
NO : Check battery (Refer to GROUP 54A – Battery – On-vehicle Service – Battery Test P.54A-5).

STEP 2. M.U.T.-III data list

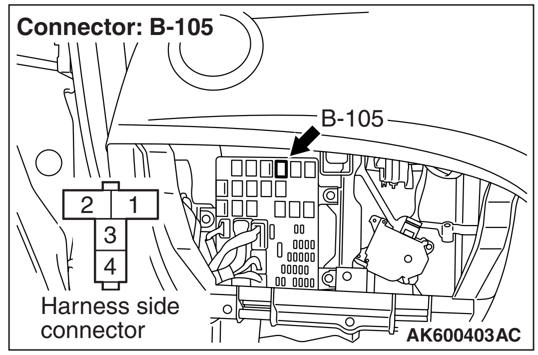
- Item 18: Cranking signal

OK:
ON (Ignition switch: ST)
OFF (Ignition switch: ON)

Q: Is the check result normal?

YES : Go to Step 17 .
NO : Go to Step 3 .

STEP 3. Connector check: C-105 starter relay connector



Q: Is the check result normal?

YES : Go to Step 4 .
NO : Repair or replace.

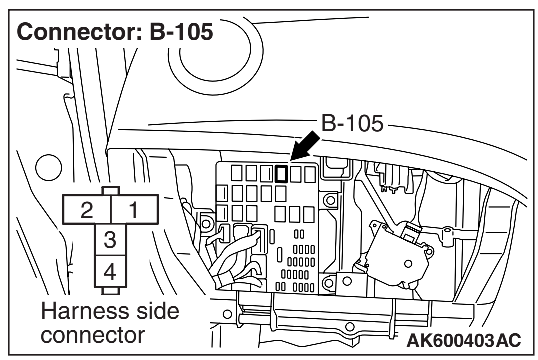
STEP 4. Check starter relay.

- Check starter relay (Refer to GROUP 16 – Starting system – Starter relay check P.16-21).

Q: Is the check result normal?

YES : Go to Step 5 .
NO : Replace starter relay.

STEP 5. Perform voltage measurement at B-105 starter relay connector.



- Disconnect connector, and measure at the harness side.
- Ignition switch: ST
- Voltage between terminal No. 1, 3 and earth.

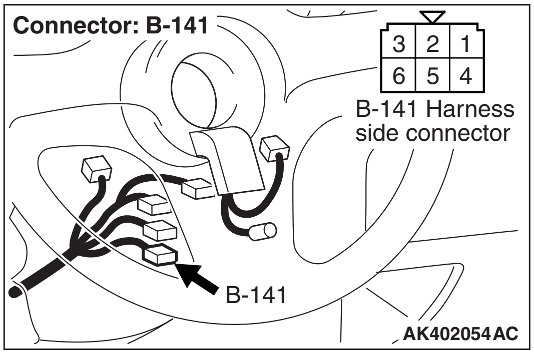
OK: System voltage

Q: Is the check result normal?

YES : Go to Step 8 .
NO : Go to Step 6 .

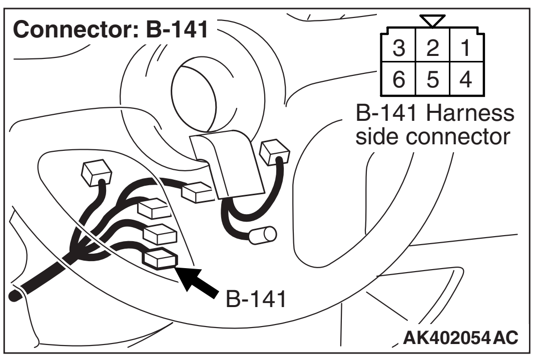
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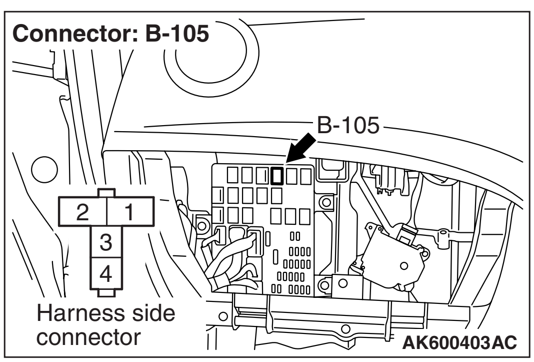
STEP 6. Connector check: B-141 ignition switch connector



Q: Is the check result normal?
YES : Go to Step 7 .
NO : Repair or replace.

STEP 7. Check ignition switch.



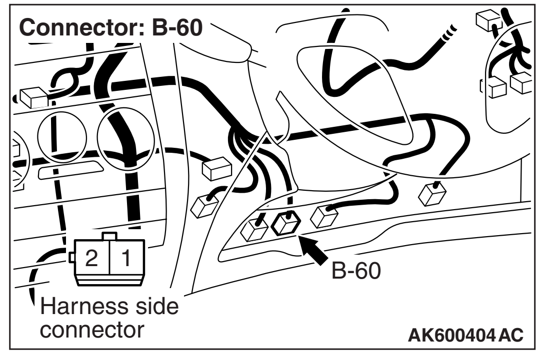


- Check ignition switch (Refer to GROUP 54 – Ignition Switch – Ignition Switch – Inspection P.54A-27).

Q: Is the check result normal?
YES : Check intermediate connector B-129, and repair if necessary. If intermediate connector is normal, check and repair harness between B-141 (terminal No. 5) ignition switch connector and B-105 starter relay connector.
  - Check power supply line for open/short circuit.

NO : Replace ignition switch.

STEP 8. Connector check: B-60 clutch switch connector



Q: Is the check result normal?
YES : Go to Step 9 .
NO : Repair or replace.

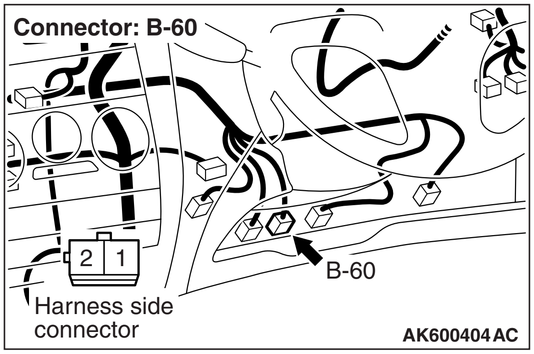
STEP 9. Check clutch switch.

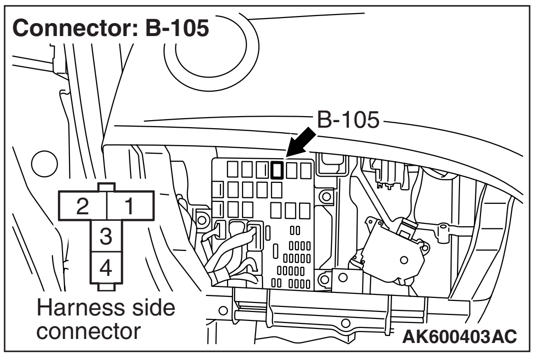
- Check clutch switch (Refer to GROUP 21 – Clutch pedal check).

Q: Is the check result normal?
YES : Go to Step 10 .
NO : Replace clutch switch.

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STEP 10. Perform voltage measurement at B-60 clutch switch connector.





- Disconnect connector, and measure at the harness side
- Ignition switch: ST
- Voltage between terminal No. 2 and earth.

OK: System voltage

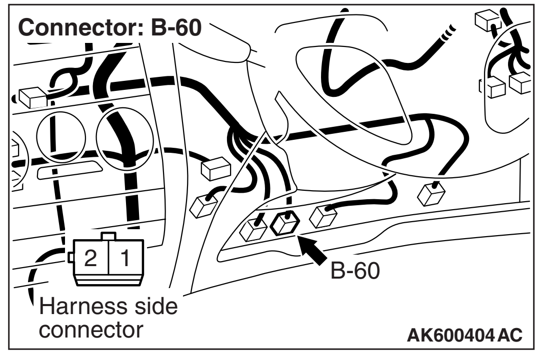
Q: Is the check result normal?

YES : Go to Step 11 .

NO : Check intermediate connector B-112, and repair if necessary. If intermediate connector is normal, check and repair harness between B-105 (terminal No. 2) starter relay connector and B-60 (terminal No. 2) clutch switch connector.

- Check power supply line for open/short circuit.

STEP 11. Perform resistance measurement at B-60 clutch switch connector.



- Disconnect connector, and measure at the harness side.
- Resistance between terminal No. 1 and earth.

OK: Continuity (2Ω or less)

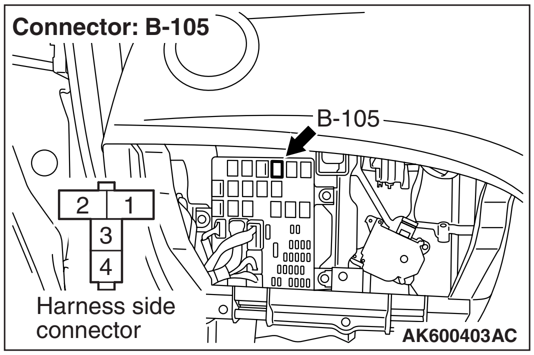
Q: Is the check result normal?

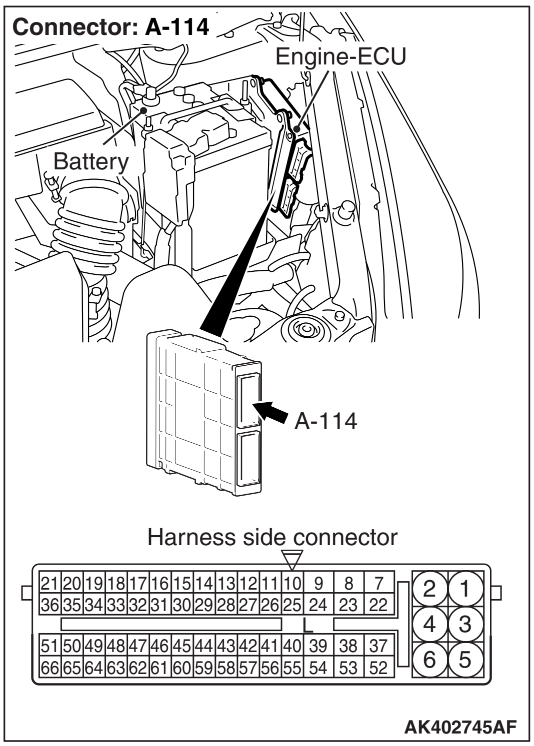
YES : Go to Step 12 .

NO : Check and repair harness between B-60 (terminal No. 1) clutch switch connector and body earth. Check earth line for open circuit and damage.

- Check earth line for open circuit and damage.

STEP 12. Check harness between B-105 (terminal No. 4) starter relay connector and A-114 (terminal No. 39) engine-ECU connector.



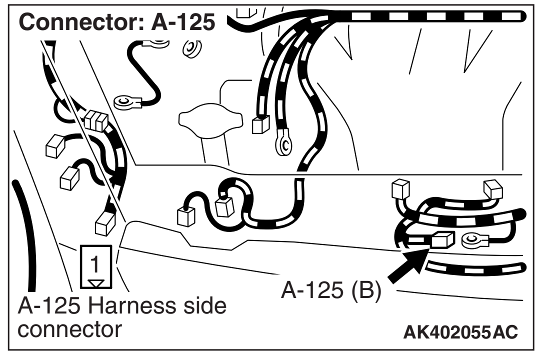


NOTE: Before checking harness, check intermediate connectors B-109 and A-17, and repair if necessary.

- *Check output line for open/short circuit and damage.*

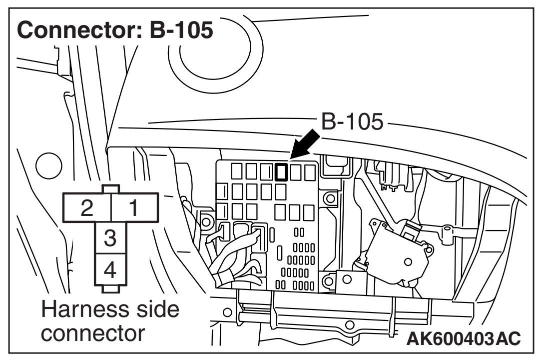
Q: Is the check result normal?
YES : Go to Step 13 .
NO : Repair.

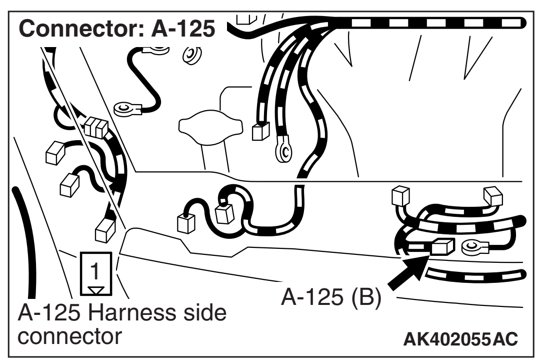
STEP 13. Connector check: A-125 starter connector



Q: Is the check result normal?
YES : Go to Step 14 .
NO : Repair or replace.

STEP 14. Check harness between B-105 (terminal No. 4) starter relay connector and A-125 (terminal No. 1) starter connector.





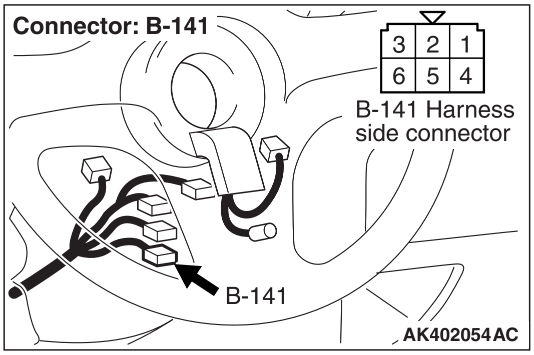
NOTE: Before checking harness, check intermediate connectors B-109 and A-17, and repair if necessary.

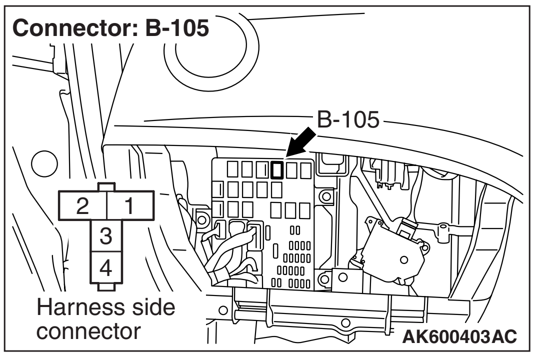
- *Check output line for short circuit.*

Q: Is the check result normal?
YES : Go to Step 15 .
NO : Repair.

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STEP 15. Check harness between B-141 (terminal No. 5) ignition switch connector and B-105 (terminal No. 1, 3) starter relay connector.



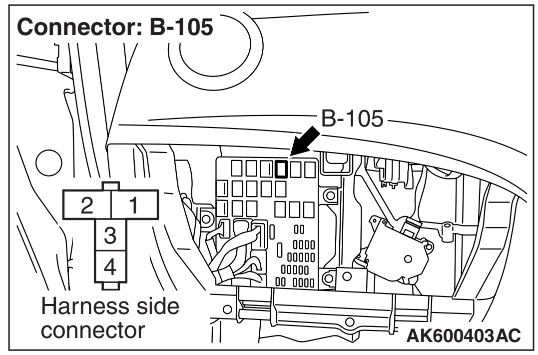


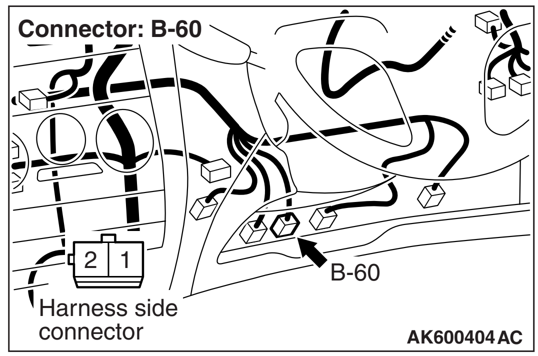
NOTE: Before checking harness, check intermediate connectors B-129, and repair if necessary.

- *Check power supply line for damage.*

Q: Is the check result normal?
YES : Go to Step 16 .
NO : Repair.

STEP 16. Check harness between B-105 (terminal No. 2) starter relay connector and B-60 (terminal No. 2) clutch switch connector.



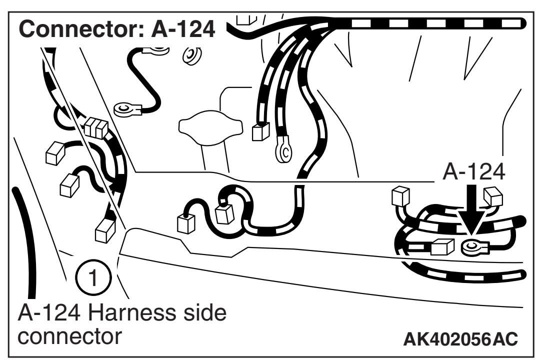


NOTE: Before checking harness, check intermediate connector B-112, and repair if necessary.

- *Check power supply line for damage.*

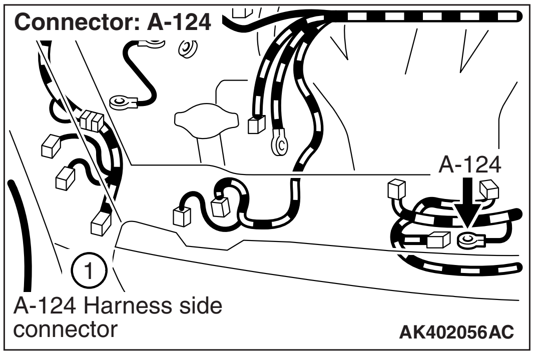
Q: Is the check result normal?
YES : Replace engine-ECU.
NO : Repair.

STEP 17. Connector check: A-124 starter connector



Q: Is the check result normal?
YES : Go to Step 18 .
NO : Repair or replace.

STEP 18. Perform voltage measurement at A-124 starter connector.



- Disconnect connector, and measure at the harness side.
- Voltage between terminal No. 1 and earth.

OK: System voltage

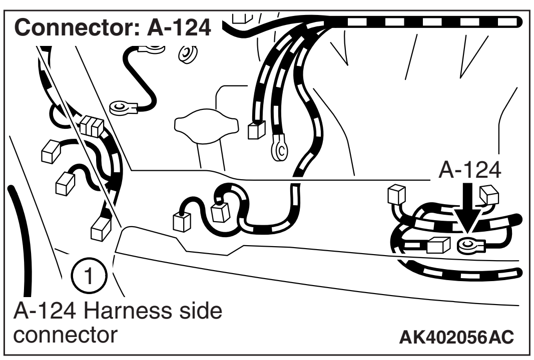
Q: Is the check result normal?

YES : Go to Step 19 .

NO : Check and repair harness between battery and A-124 (terminal No.1) starter connector.

- Check power supply line for open/short circuit.

STEP 19. Check harness between battery and A-124 (terminal No. 1) starter connector.

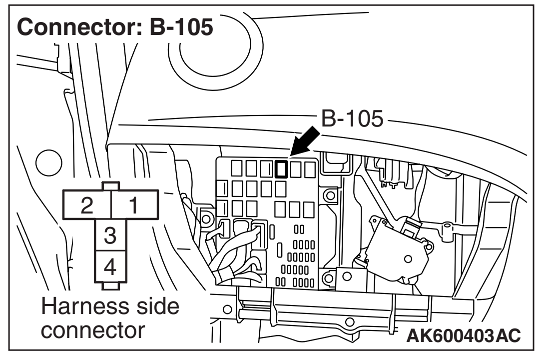


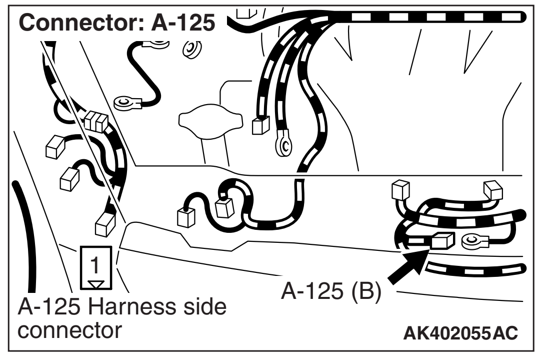
Q: Is the check result normal?

YES : Go to Step 20 .

NO : Repair.

STEP 20. Check harness between B-105 (terminal No. 4) starter relay connector and A-125 (terminal No. 1) starter connector.





NOTE: Before checking harness, check intermediate connectors B-109 and A-17, and repair if necessary.

- *Check output line for open circuit and damage.*

Q: Is the check result normal?

YES : Replace starter.

NO : Repair.

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Inspection Procedure 5: Starting Impossible (Starter Operative but No Initial Combustion)

COMMENT ON TROUBLE SYMPTOM

- Failure is possibly caused by failed ignition circuit, failed fuel feed or other faults.

PROBABLE CAUSES

- Failed battery
- Broken timing belt
- Throttle valve body fouled
- Failed ignition system
- Failed fuel system
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Check battery voltage.

- Perform voltage measurement during cranking.

OK: 8V or higher

Q: Is the check result normal?

YES : Go to Step 2 .
NO : Check battery (Refer to GROUP 54A – Battery – On-vehicle Service – Battery Test P.54A-5).

STEP 2. With M.U.T.-III of communication

- Confirm the communication available M.U.T.-III and engine-ECU.

Q: Is the check result normal?

YES : Go to Step 3 .
NO : Check engine-ECU power source, engine control relay, and ignition switch IG1 system (Refer to Inspection Procedure 21 P.13B-282).

STEP 3. M.U.T.-III diagnosis code

Q: Is the diagnosis code output?

YES : Inspection chart for diagnosis codes (Refer to P.13B-18).
NO : Go to Step 4 .

STEP 4. M.U.T.-III actuator test

- Item 07: Fuel pump

OK: There should be fuel pump operating sound.

Q: Is the check result normal?

YES : Go to Step 5 .
NO : Check fuel pump system (Refer to Inspection Procedure 22 P.13B-290).

STEP 5. Check timing belt for breakage.

- Engine: Cranking

OK: Camshaft rotates.

Q: Is the check result normal?

YES : Go to Step 6 .
NO : Replace timing belt.

STEP 6. Check throttle body (throttle valve) for contamination.

Q: Is the check result normal?

YES : Go to Step 7 .
NO : Clean throttle body (throttle valve) (Refer to P.13B-358).

STEP 7. M.U.T.-III data list

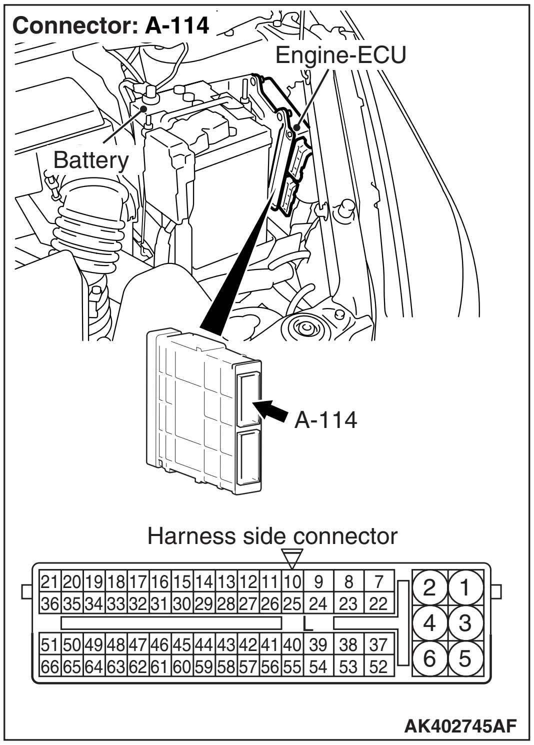
- Refer to Data List Reference Table P.13B-335.
  a. Item 18: Cranking signal

Q: Is the check result normal?

YES : Go to Step 9 .
NO : Go to Step 8 .

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STEP 8: Connector check: A-114 engine-ECU connector



Q: Is the check result normal?

YES : Check and repair harness between A-125 (terminal No. 1) starter connector and A-114 (terminal No. 39) engine-ECU connector.
- Check output line for open circuit or damage.

NO : Repair or replace.

STEP 9. M.U.T.-III data list

- Refer to Data List Reference Table P.13B-335.
  a. Item 22: Crank angle sensor

Q: Is the check result normal?

YES : Go to Step 10 .

NO : Check crank angle sensor system (Refer to Code No. P0335 P.13B-142).

STEP 10. Visual check of ignition spark.

- Remove the spark plug and install it to the ignition coil.
- Connect the ignition coil connector.
- Remove all injector connector.
- At the engine start, check each spark plug produces a spark.

Q: Is the check result normal?

YES : Go to Step 12

NO : Go to Step 11

STEP 11. Check spark plug.

- Check spark plug (Refer to GROUP 16 – Ignition System – On-vehicle Service P.16-35).

Q: Is the check result normal?

YES : Check ignition circuit system (Refer to Inspection Procedure 26 P.13B-327).

NO : Replace spark plug.

STEP 12. Check injector for operating sound.

- While cranking the engine, check each injector for operating sound (Refer to P.13B-367).

Q: Can operating sound be heard?

YES : Go to Step 13

NO : Check the injector system of the defective cylinder.
(Refer to Code No. P0201: No. 1 injector system P.13B-92).
(Refer to Code No. P0202: No. 2 injector system P.13B-97).
(Refer to Code No. P0203: No. 3 injector system P.13B-102)
(Refer to Code No. P0204: No. 4 injector system P.13B-107).

STEP 13. Fuel pressure measurement

- Fuel pressure measurement (Refer to Fuel Pressure Test P.13B-358).

Q: Is the check result normal?

YES : Go to Step 14 .

NO : Repair.

STEP 14. Replace engine-ECU

- After replacing the engine-ECU, re-check the trouble symptoms.

Q: Does trouble symptom recur?

YES : Check if there is foreign material (water, kerosene, etc.) in fuel. Replace as required.

NO : Check end.

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Inspection Procedure 6: Starting Impossible (Initial Combustion But No Complete Combustion), Improper Starting (Long Time to Start)

COMMENT ON TROUBLE SYMPTOM

- Failure is possibly caused by poor ignition, incorrect air-fuel ratio at cranking, improper fuel pressure or other faults.

PROBABLE CAUSES

- Failed battery
- Failed ignition system
- Failed fuel system
- Failed air-fuel ratio control system
- Failed intake system
- Failed exhaust emission control system
- Throttle valve body fouled
- Incorrectly installed timing belt
- Incorrect compression pressure
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Check battery condition.

Q: Have the battery terminals been disconnected recently?

YES : Perform idle learning (Refer to GROUP 00 – Precautions Before Service – Learning Procedure for Idling in MPI Engine P.00-21).
NO : Go to Step 2 .

STEP 2. Check battery voltage.

- Perform battery voltage measurement during cranking.

OK: 8 V or higher

Q: Is the check result normal?

YES : Go to Step 3 .
NO : Check battery (Refer to GROUP 54A – Battery – On-vehicle Service – Battery Test P.54A-5).

STEP 3. M.U.T.-III diagnosis code

Q: Is the diagnosis code output?

YES : Inspection chart for diagnosis codes (Refer to P.13B-18).
NO : Go to Step 4 .

STEP 4. M.U.T.-III data list

- Refer to Data List Reference Table P.13B-335.
  a. Item 12: Air flow sensor
  b. Item 13: Intake air temperature sensor
  c. Item 21: Engine coolant temperature sensor
  d. Item 25: Barometric pressure sensor

Q: Are the check results normal?

YES : Go to Step 5 .
NO : Perform the diagnosis code classified check procedure for the sensor that has shown an abnormal data value (Refer to Inspection Chart for Diagnosis Code P.13B-18).

STEP 5. Check throttle body (throttle valve) for contamination.

Q: Is the check result normal?

YES : Go to Step 6 .
NO : Clean throttle body (throttle valve) (Refer to P.13B-358).

STEP 6. M.U.T.-III actuator test

- Item 07: Fuel pump relay

OK: There should be fuel pump operating sound.

Q: Is the check result normal?

YES : Go to Step 7 .
NO : Check fuel pump system (Refer to Inspection Procedure 22 P.13B-290).

STEP 7. Check air intake from intake hose and intake manifold.

Q: Is the check result normal?

YES : Go to Step 8 .
NO : Repair.

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STEP 8. Check injector for operating sound.

- While cranking the engine, check each injector for operating sound (Refer to P.13B-367).

Q: Is there injector operating sound?

YES : Go to Step 9 .

NO : Check the injector system of the effective cylinder.
(Refer to Code No. P0201: No. 1 injector system P.13B-92).
(Refer to Code No. P0202: No. 2 injector system P.13B-97).
(Refer to Code No. P0203: No. 3 injector system P.13B-102).
(Refer to Code No. P0204: No. 4 injector system P.13B-107).

STEP 9. Check timing marks of the timing belt.

Q: Is the check result normal?

YES : Go to Step 10 .

NO : Align timing marks.

STEP 10. Visual check of ignition spark.

- Remove the spark plug and install it to the ignition coil.
- Connect the ignition coil connector.
- Remove all injector connector.
- At the engine start, check each spark plug produces a spark.

Q: Is the check result normal?

YES : Go to Step 12

NO : Go to Step 11

STEP 11. Check spark plug.

- Check spark plug (Refer to GROUP 16 – Ignition System – On-vehicle Service P.16-35).

Q: Is the check result normal?

YES : Check ignition circuit system (Refer to Inspection Procedure 26 P.13B-327).

NO : Replace spark plug.

STEP 12. Check injector spray condition.

- Check every injector for correct spray condition (Refer to P.13B-367).

Q: Is the check result normal?

YES : Go to Step 13 .

NO : Replace injector.

STEP 13. Fuel pressure measurement

- Perform fuel pressure measurement (Refer to Fuel Pressure Test P.13B-358).

Q: Is the check result normal?

YES : Go to Step 14 .

NO : Repair.

STEP 14. Check compression pressure.

- Check compression pressure (Refer to GROUP 11C – On-vehicle Service – Compression Pressure Check P.11C-13).

Q: Is the check result normal?

YES : Go to Step 15 .

NO : Repair.

STEP 15. Replace engine-ECU

- After replacing the engine-ECU, re-check the trouble symptoms.

Q: Does trouble symptom recur?

YES : Check if there is foreign material (water, kerosene, etc.) in fuel. Replace as required.

NO : Check end.

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Inspection Procedure 7: Unstable Idling (Rough Idling, Hunting), Improper Idling Speed (Too High or too Low), Engine Stalls during Idling (Die Out)

COMMENT ON TROUBLE SYMPTOM

- Probable causes range widely from ignition system, air-fuel ratio, and electronically controlled throttle valve, to fuel system. A sudden engine stall is possibly caused by poor connector contact.

PROBABLE CAUSES

- Failed ignition system
- Failed fuel system
- Failed air-fuel ratio control system
- Failed intake/exhaust system
- Failed exhaust emission control system
- Throttle valve body fouled
- Incorrectly installed timing belt
- Incorrect compression pressure
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Check battery condition.

Q: Have the battery terminals been disconnected recently?

YES : Perform idle learning (Refer to GROUP 00 – Precautions Before Service Learning Procedure for Idling in MPI Engine P.00-21).
NO : Go to Step 2 .

STEP 2. M.U.T.-III diagnosis code

Q: Is the diagnosis code output?

YES : Inspection chart for diagnosis codes (Refer to P.13B-18).
NO : Go to Step 3 .

STEP 3. M.U.T.-III data list

- Refer to Data List Reference Table P.13B-335.
  a. Item 12: Air flow sensor
  b. Item 13: Intake air temperature sensor
  c. Item 14: Throttle position sensor (sub)
  d. Item 21: Engine coolant temperature sensor
  e. Item 25: Barometric pressure sensor
  f. Item 77: Accelerator pedal position sensor (sub)
  g. Item 78: Accelerator pedal position sensor (main)
  h. Item 79: Throttle position sensor (main)

Q: Are the check results normal?

YES : Go to Step 4 .
NO : Perform the diagnosis code classified check procedure for the sensor that has shown an abnormal data value (Refer to Inspection Chart for Diagnosis Code P.13B-18).

STEP 4. M.U.T.-III data list

- Refer to Data List Reference Table P.13B-335.
  a. Item 67: Stop lamp switch

Q: Are the check results normal?

YES : Go to Step 5 .
NO : Perform the diagnosis code classified check procedure for the switch that has shown an abnormal data value (Refer to P.13B-20).

STEP 5. Check air intake from intake hose and intake manifold.

Q: Is the check result normal?

YES : Go to Step 6 .
NO : Repair.

STEP 6. Check timing marks of the timing belt.

Q: Is the check result normal?

YES : Go to Step 7 .
NO : Align timing marks.

STEP 7. Check throttle body (throttle valve) for contamination.

Q: Is the check result normal?

YES : Go to Step 8 .
NO : Clean throttle body (throttle valve) (Refer to P.13B-358).

STEP 8. M.U.T.-III data list

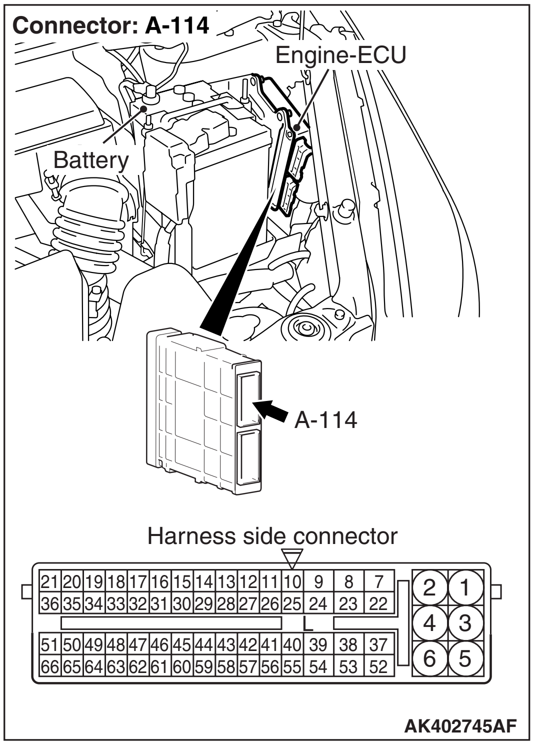
- Refer to Data List Reference Table P.13B-335.
  a. Item 11: oxygen sensor (front)
  b. Item 59: oxygen sensor (rear)

Q: Is the check results normal?

YES : Go to Step 9 .
NO : Perform the diagnosis code classified check procedure for the switch that has shown an abnormal data value (Refer to Inspection Chart for Diagnosis Code P.13B-18).

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STEP 9. Perform voltage measurement at A-114 engine-ECU connector.

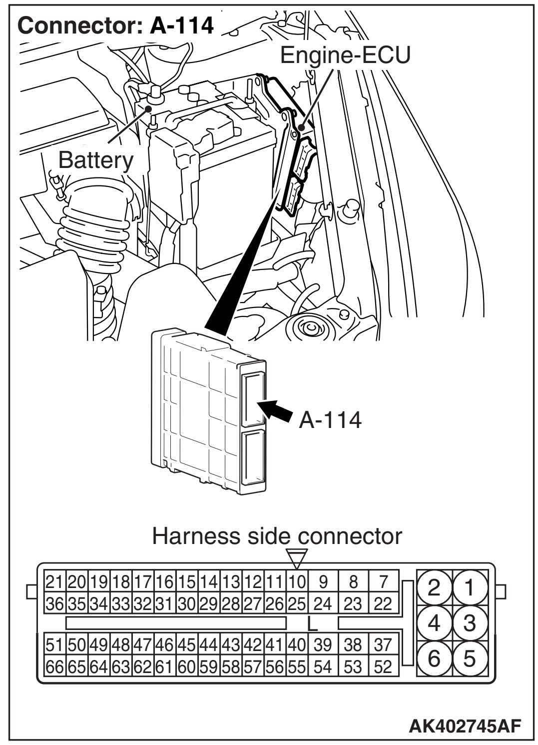


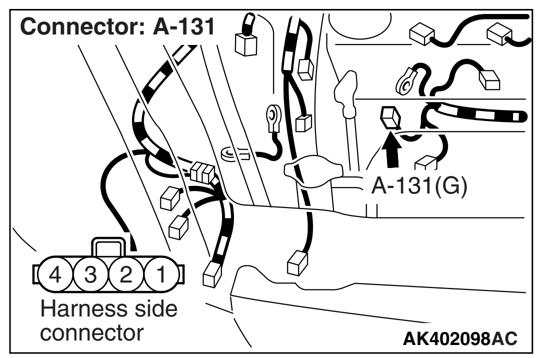
- Disconnect engine-ECU connector, and connect Special Tool Power Plant ECU Check Harness (MB991987), and then measure the voltage on the check connector.
- Engine: Idling after warm-up
- Transmission: Neutral
- Radiator fan: Not operating
- Voltage between terminal No. 64 and earth.

OK: Switching the headlamps to ON from OFF causes the voltage to increase 0.2 – 3.5 V.

Q: Is the check result normal?
YES : Go to Step 13 .
NO : Go to Step 10 .

STEP 10. Connector check: A-114 engine-ECU connector and A-131 alternator connector

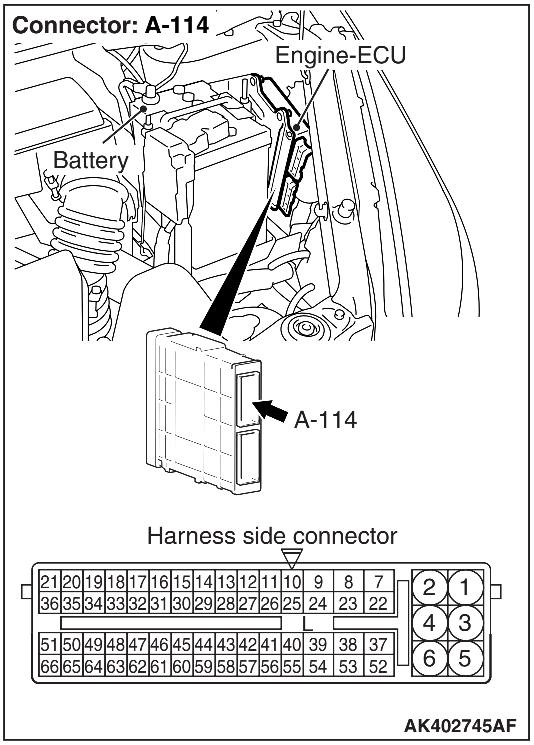


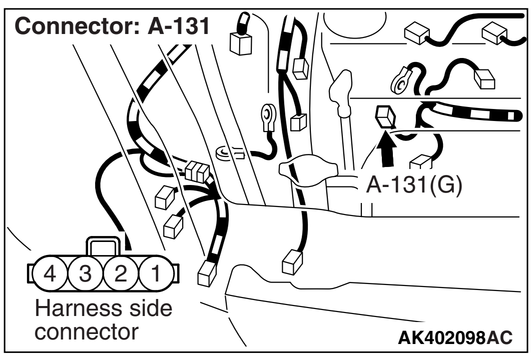


Q: Is the check result normal?
YES : Go to Step 11 .
NO : Repair or replace.

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STEP 11. Check harness between A-114 (terminal No. 64) engine-ECU connector and A-131 (terminal No. 1) alternator connector.





- Check output line for open/short circuit or damage.

Q: Is the check result normal?
YES : Go to Step 12 .
NO : Repair.

STEP 12. Check the trouble symptom.

Q: Does trouble symptom recur?
YES : Replace alternator.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

STEP 13. Visual check of ignition spark.

- Remove the spark plug and install it to the ignition coil.
- Connect the ignition coil connector.
- Remove all injector connector.
- At the engine start, check each spark plug produces a spark.

Q: Is the check result normal?
YES : Go to Step 15
NO : Go to Step 14

STEP 14. Check spark plug.

- Check spark plug (Refer to GROUP 16 – Ignition System – On-vehicle Service P.16-35).

Q: Is the check result normal?
YES : Check ignition circuit system (Refer to Inspection Procedure 26 P.13B-327).
NO : Replace spark plug.

STEP 15. Check purge control solenoid valve.

- Check purge control solenoid valve (Refer to GROUP 17 – Emission Control System – Evaporative Emission Control System – Purge Control Solenoid Valve Check P.17-16).

Q: Is the check result normal?
YES : Go to Step 16 .
NO : Replace purge control solenoid valve.

STEP 16. Check injector for spray condition.

- Check each injector for spray condition (Refer to P.13B-367).

Q: Is the check result normal?
YES : Go to Step 17 .
NO : Replace injector.

STEP 17. Check compression pressure.

- Check compression pressure (Refer to GROUP 11C – On-vehicle Service – Compression Pressure Check P.11C-13).

Q: Is the check result normal?
YES : Go to Step 18 .
NO : Repair.

STEP 18. Replace engine-ECU

- After engine-ECU is replaced, re-check for trouble symptom.

Q: Does trouble symptom recur?
YES : Check for foreign matters (water, kerosene, etc.) in fuel and replace if necessary.
NO : Check end.

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Inspection Procedure 8: The Engine Stalls when Starting the Car (Pass Out)

COMMENT ON TROUBLE SYMPTOM

- Engine stall on starting is possibly caused by misfire due to failed spark plug, improper air-fuel ratio at accelerator pedal depression, or other faults.
- Engine stall on deceleration is possibly caused by improper air-fuel ratio due to lack of intake air or failed EGR system.

PROBABLE CAUSES

- Failed ignition system
- Failed intake system
- Failed emission gas cleaning system
- Throttle valve fouled around
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

Q: Is the diagnosis code output?

YES : Inspection chart for diagnosis code (Refer to P.13B-18).

NO : Go to Step 2 .

STEP 2. M.U.T.-III data list

- Refer to Data List Reference Table P.13B-335.
  a. Item 14: Throttle position sensor (sub)
  b. Item 77: Accelerator pedal position sensor (sub)
  c. Item 78: Accelerator pedal position sensor (main)
  d. Item 79: Throttle position sensor (main)

Q: Are the check results normal?

YES : Go to Step 3 .

NO : Perform the diagnosis code classified check procedure for the sensor that has shown an abnormal data value (Refer to Inspection Chart to Diagnosis Code P.13B-18).

STEP 3. Check air intake from intake hose and inlet manifold.

Q: Is the check result normal?

YES : Go to Step 4 .

NO : Repair.

STEP 4. Check throttle body (throttle valve) for contamination.

Q: Is the check result normal?

YES : Go to Step 5 .

NO : Clean throttle body (throttle valve) (Refer to P.13B-358).

STEP 5. Visual check of ignition spark.

- Remove the spark plug and install it to the ignition coil.
- Connect the ignition coil connector.
- Remove all injector connector.
- At the engine start, check each spark plug produces a spark.

Q: Is the check result normal?

YES : Replace engine-ECU.

NO : Go to Step 6 .

STEP 6. Check spark plug.

- Check spark plug (Refer to GROUP 16 – Ignition System – On-vehicle Service P.16-35).

Q: Is the check result normal?

YES : Check ignition circuit system (Refer to Inspection Procedure 26 P.13B-327).

NO : Replace spark plug.

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Inspection Procedure 9: Engine Does Not Revole Up

COMMENT ON TROUBLE SYMPTOM

- Failure is possibly caused by failed electronically controlled throttle valve system, fuel system, ignition system, or other faults.

PROBABLE CAUSES

- Failed ignition system
- Failed fuel system
- Failed electronically controlled throttle valve system
- Incorrectly installed timing belt
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

Q: Is the diagnosis code output?

YES : Inspection chart for diagnosis code (Refer to P.13B-18).

NO : Go to Step 2 .

STEP 2. M.U.T.-III data list

- Refer to Data List Reference Table P.13B-335.
  - a. Item 14: Throttle position sensor (sub)
  - b. Item 77: Accelerator pedal position sensor (sub)
  - c. Item 78: Accelerator pedal position sensor (main)
  - d. Item 79: Throttle position sensor (main)

Q: Are the check results normal?

YES : Go to Step 3 .

NO : Perform the diagnosis code classified check procedure for the sensor that has shown an abnormal data value (Refer to Inspection Chart to Diagnosis Code P.13B-18).

STEP 3. Check timing marks of timing belt.

Q: Is the check result normal?

YES : Go to Step 4 .

NO : Align timing marks.

STEP 4. Visual check of ignition spark.

- Remove the spark plug and install it to the ignition coil.
- Connect the ignition coil connector.
- Remove all injector connector.
- At the engine start, check each spark plug produces a spark.

Q: Is the check result normal?

YES : Go to Step 6 .

NO : Go to Step 5 .

STEP 5. Check spark plug.

- Check spark plug (Refer to GROUP 16 – Ignition System – On-vehicle Service P.16-35).

Q: Is the check result normal?

YES : Check ignition circuit system (Refer to Inspection Procedure 26 P.13B-327).

NO : Replace spark plug.

STEP 6. Fuel pressure measurement.

- Fuel pressure measurement (Refer to Fuel Pressure Test P.13B-358).

Q: Is the check result normal?

YES : Replace engine-ECU.

NO : Repair.

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Inspection Procedure 10: Hesitation, Sag, Poor Acceleration, Stumble, Surge

COMMENT ON TROUBLE SYMPTOM

- Failure is possibly caused by failed ignition system, improper air-fuel ratio, incorrect compression pressure, or other faults.

PROBABLE CAUSES

- Failed air-fuel ratio control system
- Failed ignition system
- Failed fuel system
- Failed intake and exhaust system
- Failed exhaust gas cleaning systems
- Failed electronically controlled throttle valve system
- Throttle valve fouled
- Improper compression pressure
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

Q: Is the diagnosis code output?

YES : Inspection chart for diagnosis code (Refer to P.13B-18).

NO : Go to Step 2 .

STEP 2. Check injector for operating sound.

- Check injector for operating sound (Refer to P.13B-367).

Q: Can operating sound be heard?

YES : Go to Step 3 .

NO : Check the injector system of the defective cylinder.

(Refer to Code No. P0201: No. 1 Injector System P.13B-92).

(Refer to Code No. P0202: No. 2 Injector System P.13B-97).

(Refer to Code No. P0203: No. 3 Injector System P.13B-102).

(Refer to Code No. P0204: No. 4 Injector System P.13B-107).

STEP 3. M.U.T.-III data list

- Refer to Data List Reference Table P.13B-335.
  a. Item 13: Intake air temperature sensor
  b. Item 14: Throttle position sensor (sub)
  c. Item 21: Engine coolant temperature sensor
  d. Item 77: Accelerator pedal position sensor (sub)
  e. Item 78: Accelerator pedal position sensor (main)
  f. Item 79: Throttle position sensor (main)

Q: Are the check results normal?

YES : Go to Step 4 .

NO : Perform the diagnosis code classified check procedure for the sensor that has shown an abnormal data value (Refer to Inspection Chart for Diagnosis Code P.13B-18).

STEP 4. Check purge control solenoid valve itself.

- Check purge control solenoid valve itself (Refer to GROUP 17 – Emission Control System – Evaporative Emission Control System – Purge Control Solenoid Valve Check P.17-16).

Q: Is the check result normal?

YES : Go to Step 5 .

NO : Replace purge control solenoid valve.

STEP 5. M.U.T.-III data list

- Refer to Data List Reference Table P.13B-335.
  a. Item 11: Oxygen sensor (front)
  b. Item 59: Oxygen sensor (rear)

Q: Is the check result normal?

YES : Go to Step 6 .

NO : Perform the diagnosis code classified check procedure for the sensor that has shown an abnormal data value (Refer to Inspection Chart for Diagnosis Code P.13B-18).

STEP 6. Visual check of ignition spark.

- Remove the spark plug and install it to the ignition coil.
- Connect the ignition coil connector.
- Remove all injector connector.
- At the engine start, check each spark plug produces a spark.

Q: Is the check result normal?

YES : Go to Step 8 .

NO : Go to Step 7 .

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STEP 7. Check spark plug.

- Check spark plug (Refer to GROUP 16 – Ignition System – On-vehicle Service P.16-35).

Q: Is the check result normal?

YES : Check ignition circuit system (Refer to Inspection Procedure 26 P.13B-327).
NO : Replace spark plug.

STEP 8. Check throttle body (throttle valve) for contamination.

Q: Is the check result normal?

YES : Go to Step 9 .
NO : Clean throttle body (throttle valve) (Refer to P.13B-358).

STEP 9. M.U.T.-III actuator test

- Item 12: Waste gate solenoid valve

OK: When actuated, operating sound can be heard.

Q: Is the check result normal?

YES : Go to Step 10 .
NO : Check waste gate solenoid valve system (Refer to Code No. P0243 P.13B-119).

STEP 10. Check turbocharger boost pressure.

- Check turbocharger boost pressure (Refer to GROUP 15 – On-vehicle Service – Supercharging Pressure Control System P.15-3).

Q: Is the check result normal?

YES : Go to Step 11 .
NO : Repair.

STEP 11. Check boost pressure control system.

- Check boost pressure control system (Refer to GROUP 15 – On-vehicle Service – Supercharging Pressure Control System P.15-3).

Q: Is the check result normal?

YES : Go to Step 12 .
NO : Repair.

STEP 12. M.U.T.-III actuator test

- Item 09: Fuel pressure solenoid valve

OK: When actuated, operating sound can be heard.

Q: Is the check result normal?

YES : Go to Step 13 .
NO : Check fuel pressure solenoid valve system (Refer to Code No. P0090 P.13B-25).

STEP 13. Check compression pressure.

- Check compression pressure (Refer to GROUP 11C – On-vehicle Service – Compression Pressure Check P.11C-13).

Q: Is the check result normal?

YES : Go to Step 14 .
NO : Repair.

STEP 14. Fuel pressure measurement.

- Fuel pressure measurement (Refer to Fuel Pressure Test P.13B-358).

Q: Is the check result normal?

YES : Replace engine-ECU.
NO : Repair.

Inspection Procedure 11: The Feeling of Impact or Vibration when Accelerating

COMMENT ON TROUBLE SYMPTOM

- Failure is possibly caused by ignition leak with rise in spark plug-required voltage at acceleration, failed electronically controlled throttle valve system, or other faults.

PROBABLE CAUSES

- Failed ignition system
- Failed electronically controlled throttle valve system
- Throttle valve fouled
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

Q: Is the diagnosis code output?

YES : Inspection chart for diagnosis code (Refer to P.13B-18).
NO : Go to Step 2 .

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STEP 2. M.U.T.-III data list

- Refer to Data List Reference Table P.13B-335.
  a. Item 14: Throttle position sensor (sub)
  b. Item 77: Accelerator pedal position sensor (sub)
  c. Item 78: Accelerator pedal position sensor (main)
  d. Item 79: Throttle position sensor (main)

Q: Are the check results normal?

YES : Go to Step 3 .
NO : Perform the diagnosis code classified check procedure for the sensor that has shown an abnormal data value (Refer to Inspection Chart for Diagnosis Code P.13B-18).

STEP 3. Check throttle body (throttle valve) for contamination.

Q: Is the check result normal?

YES : Go to Step 4 .
NO : Clean throttle body (throttle valve) (Refer to P.13B-358).

STEP 4. Visual check of ignition spark.

- Remove the spark plug and install it to the ignition coil.
- Connect the ignition coil connector.
- Remove all injector connector.
- At the engine start, check each spark plug produces a spark.

Q: Is the check result normal?

YES : Replace engine-ECU.
NO : Go to Step 5 .

STEP 5. Check spark plug.

- Check spark plug (Refer to GROUP 16 – Ignition System – On-vehicle Service P.16-35).

Q: Is the check result normal?

YES : Check ignition circuit system (Refer to Inspection Procedure 26 P.13B-327).
NO : Replace spark plug.

Inspection Procedure 12: The Feeling of Impact or Vibration when Decelerating

COMMENT ON TROUBLE SYMPTOM

- Failure is possibly caused by insufficient air intake due to failed electronically controlled throttle valve system.

PROBABLE CAUSES

- Failed electronically controlled throttle valve system
- Throttle valve fouled
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

Q: Is the diagnosis code output?

YES : Inspection chart for diagnosis code (Refer to P.13B-18).
NO : Go to Step 2 .

STEP 2. M.U.T.-III data list

- Refer to Data List Reference Table P.13B-335.
  a. Item 14: Throttle position sensor (sub)
  b. Item 77: Accelerator pedal position sensor (sub)
  c. Item 78: Accelerator pedal position sensor (main)
  d. Item 79: Throttle position sensor (main)

Q: Are the check results normal?

YES : Go to Step 3 .
NO : Perform the diagnosis code classified check procedure for the sensor that has shown an abnormal data value (Refer to Inspection Chart for Diagnosis Code P.13B-18).

STEP 3. Check throttle body (throttle valve) for contamination.

Q: Is the check result normal?

YES : Replace engine-ECU.
NO : Clean throttle body (throttle valve) (Refer to P.13B-358).

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Inspection Procedure 13: Knocking

COMMENT ON TROUBLE SYMPTOM

- Failure is possibly caused by failed knock control system, improper thermal value of spark plug, or other faults.

PROBABLE CAUSES

- Failed detonation sensor
- Failed detonation control system
- Defective spark plug
- Failed ignition system
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

Q: Is the diagnosis code output?

YES : Inspection chart for diagnosis code (Refer to P.13B-18).

NO : Go to Step 2 .

STEP 2. Visual check of ignition spark.

- Remove the spark plug and install it to the ignition coil.
- Connect the ignition coil connector.
- Remove all injector connector.
- At the engine start, check each spark plug produces a spark.

Q: Is the check result normal?

YES : Check detonation sensor system (Refer to Code No. P0325 P.13B-138).

NO : Go to Step 3 .

STEP 3. Check spark plug.

- Check spark plug (Refer to GROUP 16 – Ignition System – On-vehicle Service P.16-35).

Q: Is the check result normal?

YES : Check ignition circuit system (Refer to Inspection Procedure 26 P.13B-327).

NO : Replace spark plug.

Inspection Procedure 14: Ignition Timing Offset

COMMENT ON TROUBLE SYMPTOM

- Failure is possibly caused by failed crank angle sensor, failed camshaft position sensor, incorrectly installed timing belt, or other faults.

PROBABLE CAUSES

- Failed crank angle sensor
- Failed camshaft position sensor
- Incorrectly installed timing belt
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

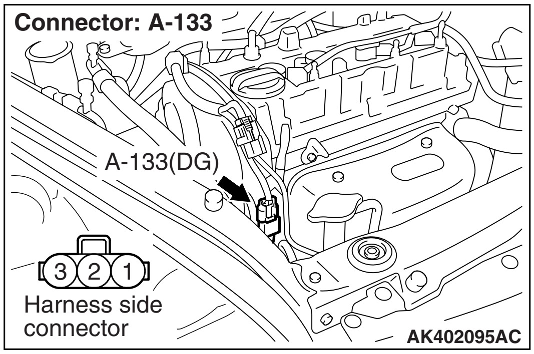
Q: Is the diagnosis code set?

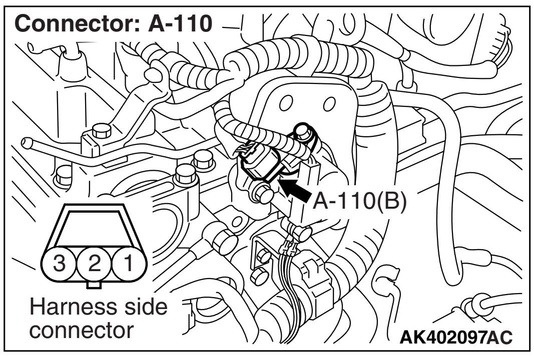
YES : Inspection chart for diagnosis code (Refer to P.13B-18).

NO : Go to Step 2 .

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STEP 2. Perform output wave pattern measurement of crank angle sensor and camshaft position sensor (Using an oscilloscope).





Crank Angle Sensor

- Use special tool test harness (MB991658) to connect A-133 crank angle sensor intermediate connector, and measure at pick-up harness.
- Engine: Idling
- Transmission: Neutral
- Voltage between terminal No. 2 and earth.

Camshaft position sensor

- Use special tool test harness (MB991709) to connect A-110 camshaft position sensor connector, and measure at pick-up harness.
- Engine: Idling
- Transmission: Neutral
- Voltage between terminal No. 2 and earth.

OK: Output waveform timings of both sensors are the same as the check procedure (Refer to P.13B-352) using an oscilloscope.

Q: Is the check result normal?
YES : Go to Step 3 .
NO : Go to Step 4 .

STEP 3. Check the trouble symptom.

Q: Does trouble symptom persist?
YES : Replace engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

STEP 4. Check crank angle sensor and camshaft position sensor mounted conditions.

Q: Is the check result normal?
YES : Go to Step 5 .
NO : Repair.

STEP 5. Check timing marks of timing belt.

Q: Is the check result normal?
YES : Go to Step 6 .
NO : Align timing marks.

STEP 6. Check crank angle sensor sensing blade.

Q: Is the check result normal?
YES : Go to Step 7 .
NO : Replace crank angle sensor sensing blade.

STEP 7. Check camshaft position sensing cylinder.

Q: Is the check result normal?
YES : Go to Step 8 .
NO : Replace camshaft position sensing cylinder.

STEP 8. Replace crank angle sensor

- After replacing the crank angle sensor, re-check the trouble symptoms.

Q: Does trouble symptom persist?
YES : Go to Step 9 .
NO : Check end.

STEP 9. Replace camshaft position sensor

- After replacing the camshaft position sensor, re-check the trouble symptoms.

Q: Does trouble symptom persist?
YES : Replace engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

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Inspection Procedure 15: Run On (Dieseling)

COMMENT ON TROUBLE SYMPTOM

- Failure is possibly caused by leakage from injector.

PROBABLE CAUSES

- Failed injector
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Check injector for spray condition.

- Check each injector for spray condition (Refer to P.13B-367).

Q: Is the check result normal?

YES : Replace engine-ECU.
NO : Replace injector.

Inspection Procedure 16: Odor, White Smoke, Black Smoke, and High-Concentration CO/HC during Idling

COMMENT ON TROUBLE SYMPTOM

- Failure is possibly caused by improper air-fuel ratio, deteriorated catalyst, failed ignition system, failed fuel system, improper compression pressure, or other faults.

PROBABLE CAUSES

- Failed air-fuel ratio control system
- Failed ignition system
- Failed fuel system
- Failed intake/exhaust system
- Failed exhaust gas cleaning systems
- Improper compression pressure
- Failed catalytic converter
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

Q: Is the diagnosis code output?

YES : Inspection chart for diagnosis code (Refer to P.13B-18).
NO : Go to Step 2 .

STEP 2. Check injector for operating sound.

- Check injector for operating sound (Refer to P.13B-367).

Q: Can operating sound be heard?

YES : Go to Step 3 .
NO : Check the injector system of the defective cylinder.
(Refer to Code No. P0201: No. 1 Injector System P.13B-92).
(Refer to Code No. P0202: No. 2 Injector System P.13B-97).
(Refer to Code No. P0203: No. 3 Injector System P.13B-102).
(Refer to Code No. P0204: No. 4 Injector System P.13B-107).

STEP 3. Check ignition timing.

- Check ignition timing (Refer to GROUP 11C – On-vehicle Service – Ignition Timing Check P.11C-12).

Q: Is the check result normal?

YES : Go to Step 4 .
NO : Check for offset ignition timing (Refer to Inspection Procedure 14 P.13B-264).

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STEP 4. M.U.T.-III data list

- Refer to Data List Reference Table P.13B-335.
  a. Item 12: Air flow sensor
  b. Item 13: Intake air temperature sensor
  c. Item 21: Engine coolant temperature sensor
  d. Item 25: Barometric pressure sensor

Q: Are the check results normal?
YES : Go to Step 5 .
NO : Perform the diagnosis code classified check procedure for the sensor that has shown an abnormal data value (Refer to Inspection Chart for Diagnosis Code P.13B-18).

STEP 5. Check air intake from intake hose and inlet manifold.

Q: Is the check result normal?
YES : Go to Step 6 .
NO : Repair.

STEP 6. Check exhaust manifold for emission leakage.

Q: Is the check result normal?
YES : Go to Step 7 .
NO : Repair.

STEP 7. Check throttle body (throttle valve) for contamination.

Q: Is the check result normal?
YES : Go to Step 8 .
NO : Clean throttle body (throttle valve) (Refer to P.13B-358).

STEP 8. M.U.T.-III data list

- Refer to Data List Reference Table P.13B-335.
  a. Item 11: Oxygen sensor (front)
  b. Item 59: Oxygen sensor (rear)

Q: Is the check result normal?
YES : Go to Step 9 .
NO : Perform the diagnosis code classified check procedure for the sensor that has shown an abnormal data value (Refer to Inspection Chart for Diagnosis Code P.13B-18).

STEP 9. Check purge control solenoid valve.

- Check purge control solenoid valve (Refer to GROUP 17 − Emission Control System − Evaporative Emission Control System − Purge Control Solenoid Valve Check P.17-16).

Q: Is the check result normal?
YES : Go to Step 10 .
NO : Replace purge control solenoid valve.

STEP 10. Fuel pressure measurement.

- Fuel pressure measurement (Refer to Fuel Pressure Test P.13B-358).

Q: Is the check result normal?
YES : Go to Step 11 .
NO : Repair.

STEP 11. Check positive crankcase ventilation valve.

- Check positive crankcase ventilation valve (Refer to GROUP 17 − Emission Control System − Crankcase Emission Control System − Positive Crankcase Ventilation (PCV) Valve Check P.17-13).

Q: Is the check result normal?
YES : Go to Step 12 .
NO : Replace positive crankcase ventilation valve.

STEP 12. Visual check of ignition spark.

- Remove the spark plug and install it to the ignition coil.
- Connect the ignition coil connector.
- Remove all injector connector.
- At the engine start, check each spark plug produces a spark.

Q: Is the check result normal?
YES : Go to Step 14 .
NO : Go to Step 13 .

STEP 13. Check spark plug.

- Check spark plug (Refer to GROUP 16 − Ignition System − On-vehicle Service P.16-35).

Q: Is the check result normal?
YES : Check ignition circuit system (Refer to Inspection Procedure 26 P.13B-327).
NO : Replace spark plug.

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Group TOC

STEP 14. Check compression pressure.

- Check compression pressure (Refer to GROUP 11C – On-vehicle Service – Compression Pressure Check P.11C-13).

Q: Is the check result normal?

YES : Go to Step 15 .
NO : Repair.

STEP 15. Check injector for spray condition.

- Check each injector for spray condition (Refer to P.13B-367).

Q: Is the check result normal?

YES : Go to Step 16 .
NO : Replace injector.

STEP 16. Replace catalytic converter

- After replacing the catalytic converter, re-check the trouble symptoms.

Q: Does trouble symptom persist?

YES : Replace engine-ECU.
NO : Check end.

Inspection Procedure 17: Battery Run Down

COMMENT ON TROUBLE SYMPTOM

- Failure is possibly caused by failed alternator, failed power generation control system, or other faults.

PROBABLE CAUSES

- Failed battery
- Alternator G terminal short-circuited
- Failed alternator
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Check battery voltage.

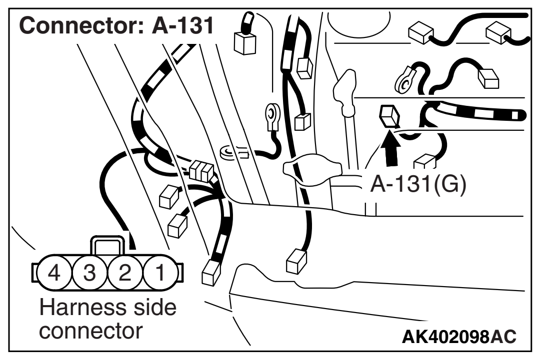
- Measure battery voltage during cranking

OK: 8 V or more

Q: Is the check result normal?

YES : Go to Step 2 .
NO : Check battery (Refer to GROUP 54A – Battery – On-vehicle Service – Battery Test P.54A-5).

STEP 2. Connector check: A-131 alternator connector

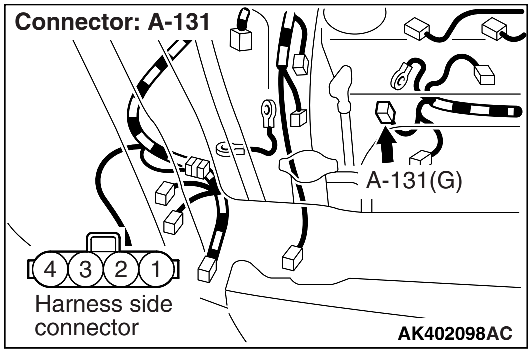


Q: Is the check result normal?

YES : Go to Step 3 .
NO : Repair or replace.

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Group TOC

STEP 3. Perform voltage measurement at A-131 alternator connector.



Disconnect connector and measure at harness side.

- Ignition switch: ON
- Voltage between terminal No. 3 and earth.

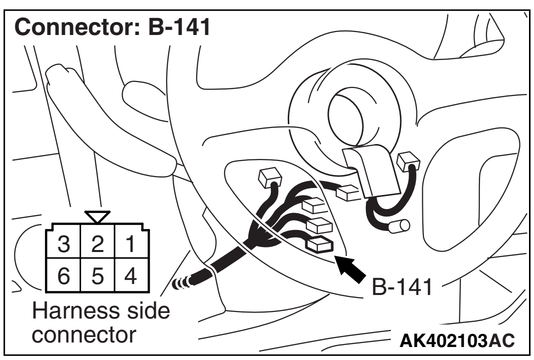
OK: System voltage

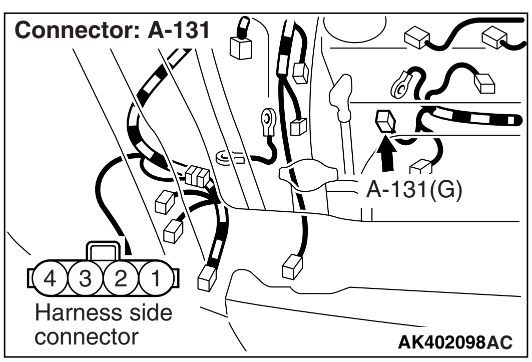
Q: Is the check result normal?

YES : Go to Step 5 .

NO : Go to Step 4 .

STEP 4. Connector check: B-141 ignition switch connector





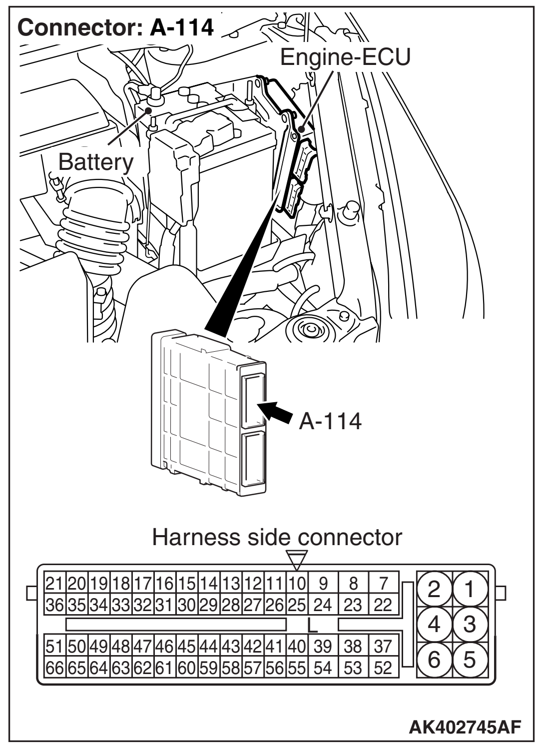
Q: Is the check result normal?

YES : Check intermediate connectors A-17, B-41, B-14, B-22, B-131, B-129, and repair if necessary. If intermediate connectors are normal, check and repair harness between B-141 (terminal No. 2) ignition switch connector and A-131 (terminal No. 3) alternator connector.

- Check power supply line for open/short circuit.

NO : Repair or replace.

STEP 5. Connector check: A-114 engine-ECU connector



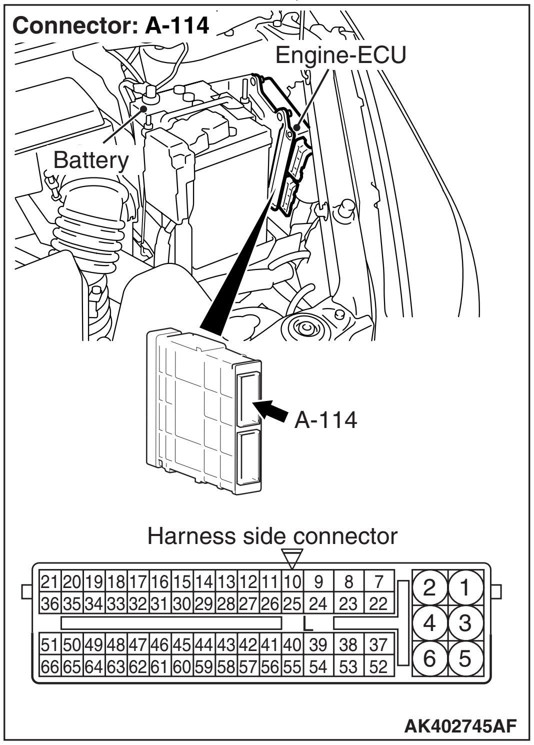
Q: Is the check result normal?

YES : Go to Step 6 .

NO : Repair or replace.

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Group TOC

STEP 6. Perform voltage measurement at A-114 engine-ECU connector.



Disconnect connector and measure at harness side.

- Ignition switch: ON
- Voltage between terminal No. 64 and earth.

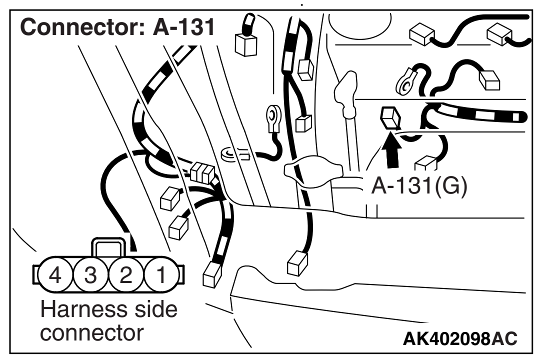
OK: System voltage

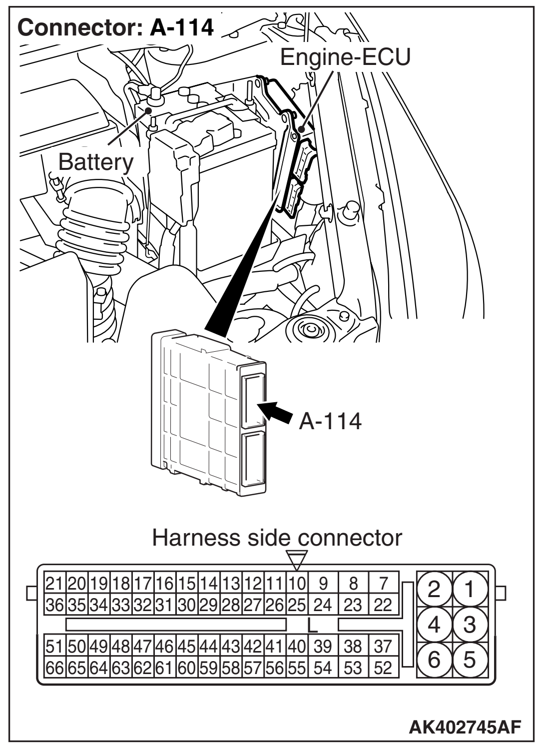
Q: Is the check result normal?

YES : Go to Step 8 .

NO : Go to Step 7 .

STEP 7. Check harness between A-131 (terminal No. 1) alternator connector and A-114 (terminal No. 64) engine-ECU connector.





Check output line for open/short circuit.

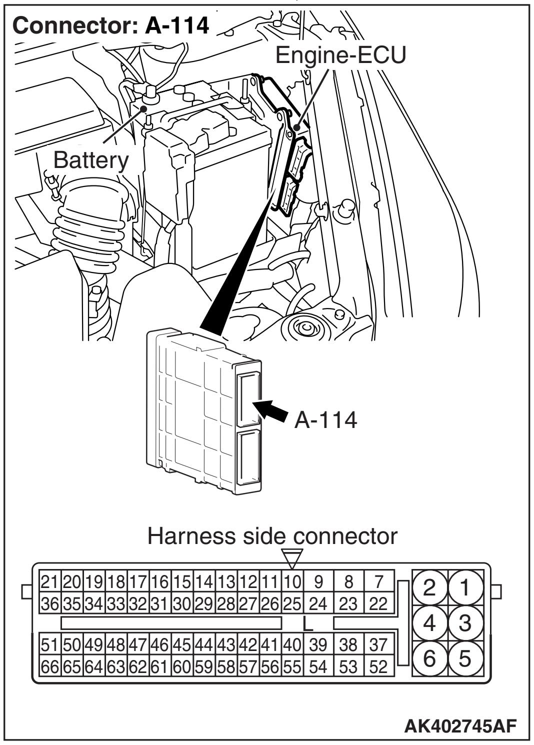
Q: Is the check result normal?

YES : Replace alternator.

NO : Repair.

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STEP 8. Perform voltage measurement at A-114 engine-ECU connector.



Disconnect engine-ECU connector, and connect Special Tool Power Plant ECU Check Harness (MB991987), and measure the voltage on the check connector.

- Engine: Idling after warm-up
- Transmission: Neutral
- Cooling fan: Inactive
- Voltage between terminal No. 64 and earth.

OK: Switching the headlamps to ON from OFF causes the voltage to increase 0.2 – 3.5 V.

Q: Is the check result normal?

YES : Go to Step 9 .

NO : Check alternator.

STEP 9. Check the trouble symptom.

Q: Does trouble symptom recur?

YES : Replace engine-ECU.

NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

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Inspection Procedure 18: Overheating

COMMENT ON TROUBLE SYMPTOM

- Failure is possibly caused by failed engine cooling system, failed engine coolant temperature sensor, or other faults.

PROBABLE CAUSES

- Lack of or deteriorated engine coolant
- Failed fan control relay
- Failed engine coolant temperature sensor
- Failed thermostat
- Failed water pump
- Failed radiator core
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

Q: Is the diagnosis code output?

YES : Inspection chart for diagnosis code (Refer to P.13B-18).
NO : Go to Step 2.

STEP 2. Check engine coolant.

NOTE: If engine coolant level falls too early, check for leaky spots, and repair if necessary.

- Check engine coolant (Refer to GROUP 14 – On-vehicle Service – Engine Coolant Leak Check P.14-3).

Q: Is the check result normal?

YES : Go to Step 3.
NO : Replace or add engine coolant.

STEP 3. M.U.T.-III actuator test

- Refer to Actuator Test Reference Table P.13B-344.
  a. Item 20: Cooling fan motor (HI)
  b. Item 21: Cooling fan motor (LO)

Q: Are the check result normal?

YES : Go to Step 4.
NO : Check fan control relay system (Refer to Inspection Procedure 23 P.13B-303).

STEP 4. M.U.T.-III data list

- Item 21: Engine coolant temperature sensor

OK:
Engine cold state: At ambient temperature (atmospheric temperature) or equivalent.
Engine hot state: At 80 – 120°C

Q: Is the check result normal?

YES : Go to Step 5.
NO : Check engine coolant temperature sensor (Refer to Code No. P0115 P.13B-45).

STEP 5. Check thermostat.

- Check thermostat (Refer to GROUP 14 – Thermostat – Thermostat Inspection P.14-12).

Q: Is the check result normal?

YES : Go to Step 6.
NO : Replace thermostat.

STEP 6. Check water pump.

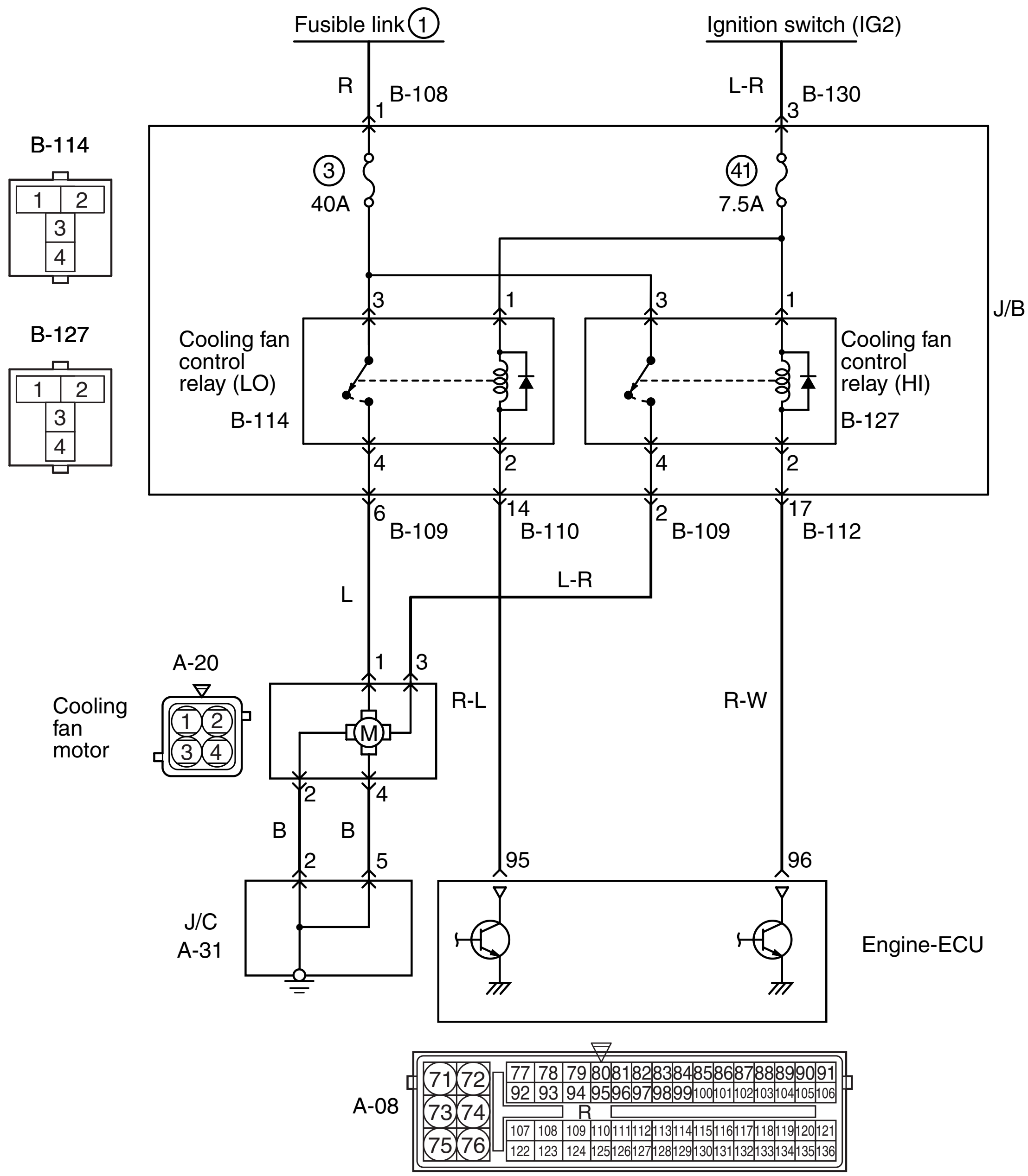
- Check water pump.

Q: Is the check result normal?

YES : Replace radiator.
NO : Replace water pump.

Inspection Procedure 19: Abnormal Rotation of Fan Motor

Cooling Fan Control Relay Circuit



Wire colour code
B: Black LG: Light green G: Green L: Blue W: White Y: Yellow SB: Sky blue BR: Brown O: Orange GR: Gray
R: Red P: Pink V: Violet P: Purple

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OPERATION

- The battery voltage is applied to the cooling fan control relay (LO) coil (terminal No. 1) and cooling fan control relay (HI) coil (terminal No. 1) from the ignition switch.
- The engine-ECU (terminal No. 95 and No. 96) turns on the switch of the power transistor on the unit, and then turns on the switch of the relay by applying the electrical current to the cooling fan control relay (LO) coil or cooling fan control relay (HI) coil.

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- When the cooling fan control relay (LO) is in ON position, the battery voltage is applied to the cooling fan motor (terminal No. 1) from the cooling fan control relay (LO) (terminal No. 4).
- When the cooling fan control relay (LO) and cooling fan control relay (HI) are in ON position, the battery voltage is applied to the cooling fan motor (terminal No. 3) from the cooling fan control relay (HI) (terminal No. 4).

FUNCTION

- When the cooling fan control relay (LO) is in ON position, the fan motor rotates with the low speed.
- When the cooling fan control relay (LO) and the cooling fan control relay (HI) are in ON position, the fan motor rotates with the high speed.

PROBABLE CAUSES

- Failed cooling fan motor
- Open/short circuit in or damage to the cooling fan control relay circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

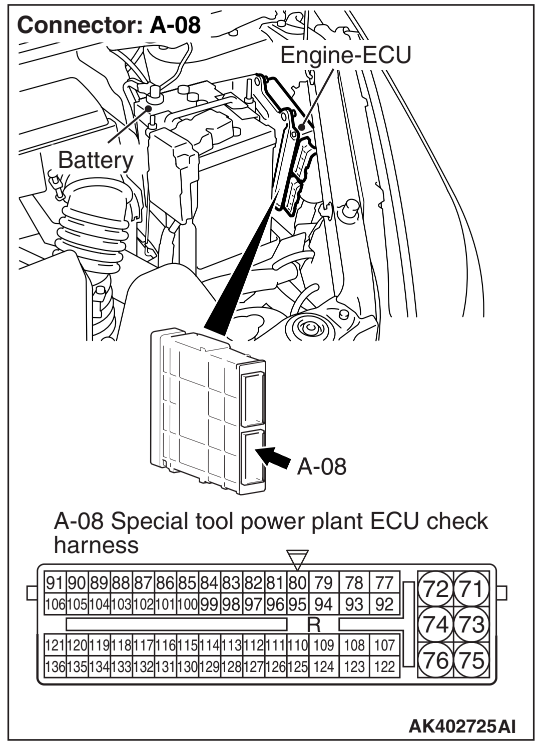
STEP 1. Check cooling fan motor.

- Check cooling fan motor (Refer to GROUP 14 – On-vehicle Service – Cooling Fan Motor Inspection P.14-9).

Q: Is the check result normal?

YES : Go to Step 2 .
NO : Replace cooling fan motor.

STEP 2. Connector check: A-08 engine-ECU connector

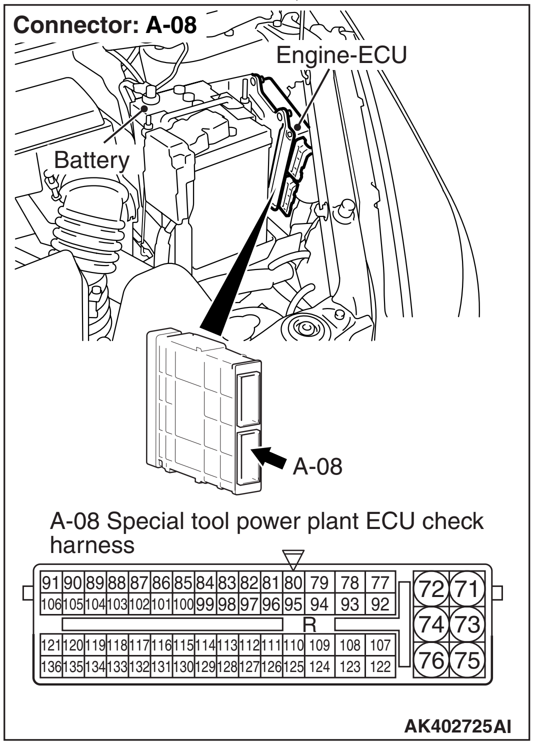


Q: Is the check result normal?

YES : Go to Step 3 .
NO : Repair or replace.

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STEP 3. Perform voltage measurement at A-08 engine-ECU connector.



Disconnect connector and measure at harness side.

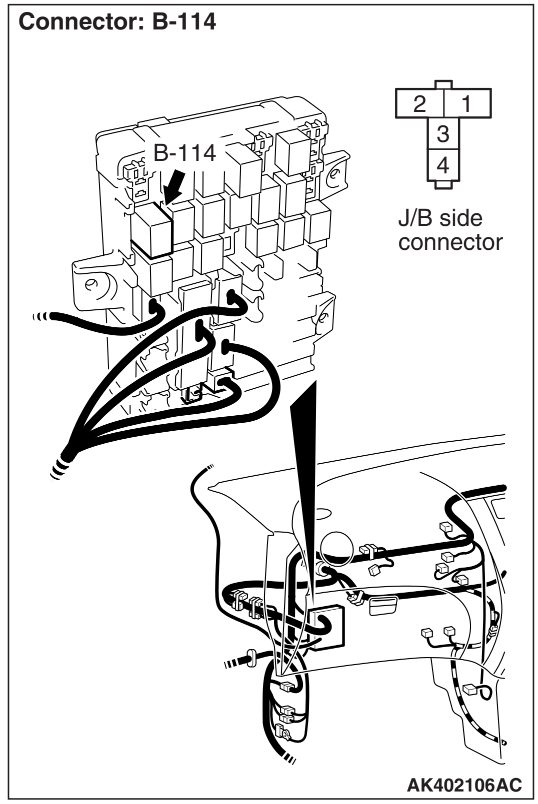
- Ignition switch: ON
- Voltage between terminal No. 95 and earth.

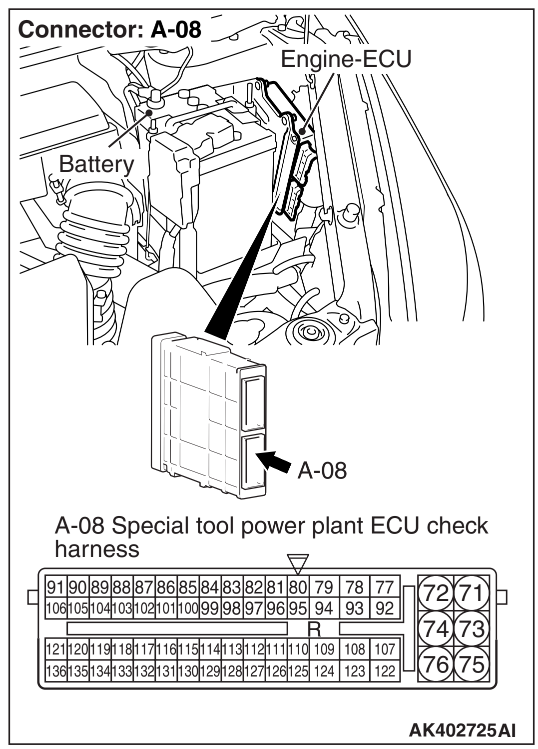
OK: System voltage

Q: Is the check result normal?

YES : Go to Step 5 .
NO : Go to Step 4 .

STEP 4. Connector check: B-114 cooling fan control relay (LO) connector





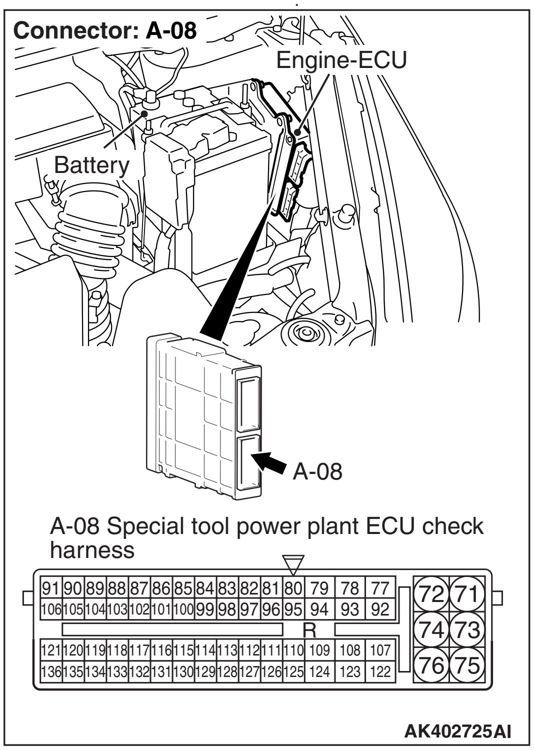
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Q: Is the check result normal?

YES : Check intermediate connector B-110, and repair if necessary. If the intermediate connector is normal, check and repair harness between B-114 (terminal No. 2) cooling fan control relay (LO) connector and A-08 (terminal No. 95) engine-ECU connector.
- Check signal line for short circuit.

NO : Repair or replace.

STEP 5. Perform voltage measurement at A-08 engine-ECU connector.



Disconnect connector and measure at harness side.
- Ignition switch: ON
- Voltage between terminal No. 96 and earth.

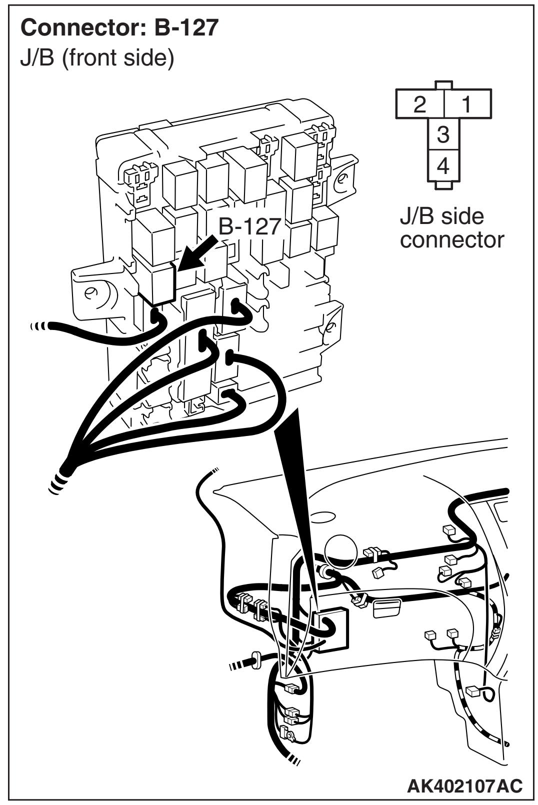
OK: System voltage

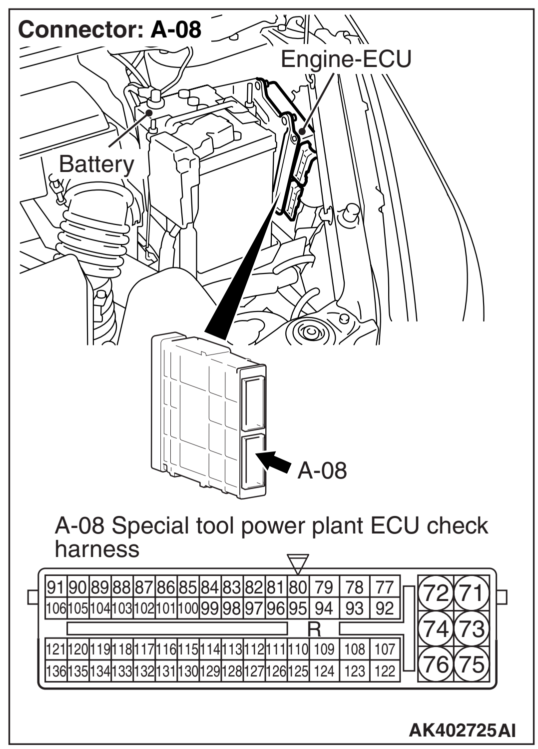
Q: Is the check result normal?

YES : Go to Step 7 .

NO : Go to Step 6 .

STEP 6. Connector check: B-127 cooling fan control relay (HI) connector





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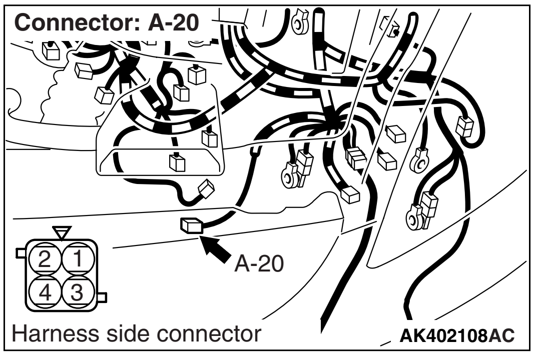
Q: Is the check result normal?

YES : Check intermediate connector B-112, and repair if necessary. If the intermediate connector is normal, check and repair harness between B-127 (terminal No. 2) cooling fan control relay (HI) connector and A-08 (terminal No. 96) engine-ECU connector.

- Check signal line for short circuit.

NO : Repair or replace.

STEP 7. Connector check: A-20 cooling fan motor connector

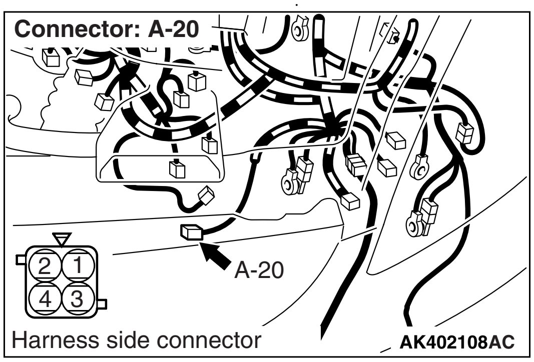


Q: Is the check result normal?

YES : Go to Step 8 .

NO : Repair or replace.

STEP 8. Perform resistance measurement at A-20 cooling fan motor connector.



Disconnect connector and measure at harness side.

- Resistance between terminal No. 2, No. 4 and earth.

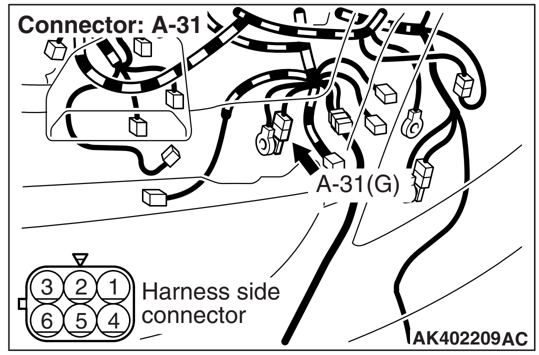
OK: Continuity (2 Ω or less)

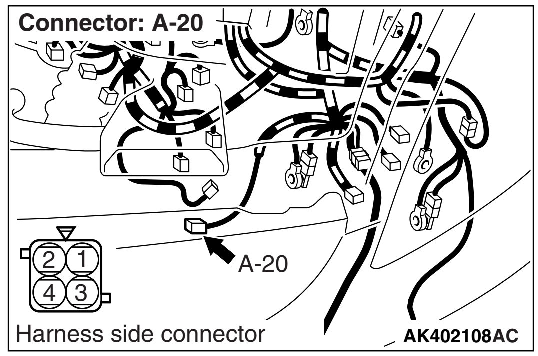
Q: Is the check result normal?

YES : Go to Step 10 .

NO : Go to Step 9 .

STEP 9. Connector check: A-31 joint connector





Q: Is the check result normal?

YES :

a. Check and repair harness between A-20 (terminal No. 2) cooling fan motor connector and A-31 (terminal No. 2) joint connector.

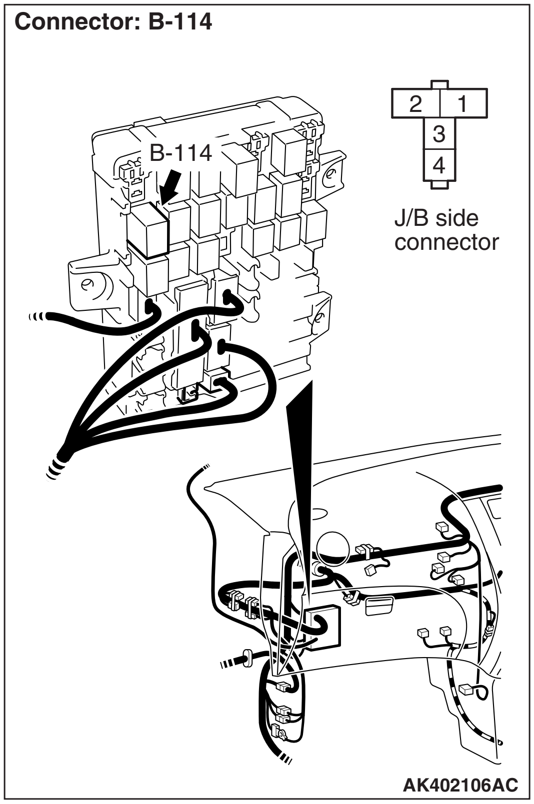
b. Check and repair harness between A-20 (terminal No. 4) cooling fan motor connector and A-31 (terminal No. 5) joint connector.

- Check earthing line for damage.

NO : Repair or replace.

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STEP 10. Connector check: B-114 cooling fan control relay (LO) connector

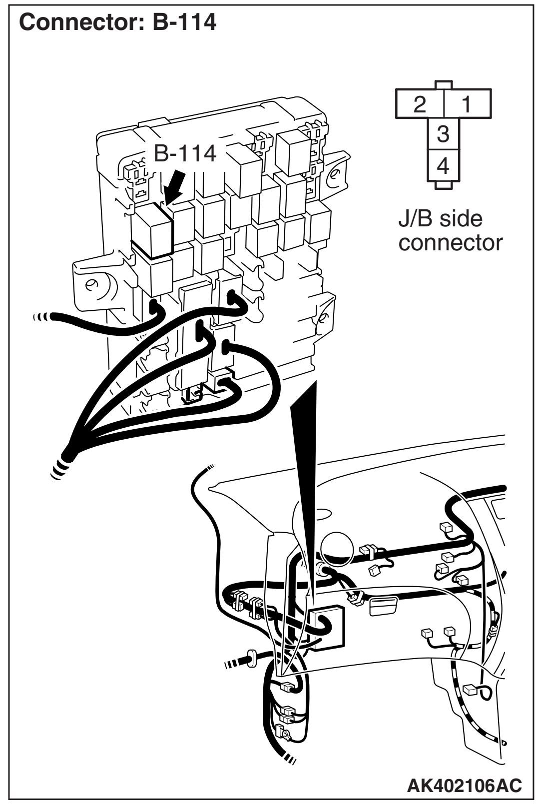


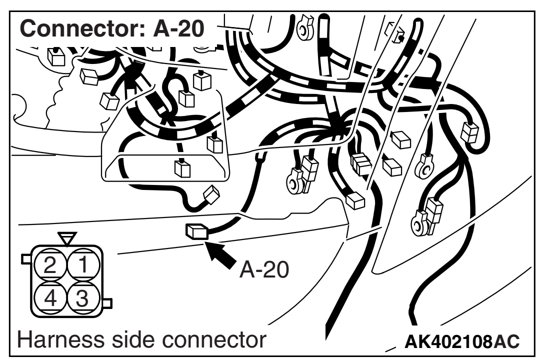
Q: Is the check result normal?

YES : Go to Step 11 .

NO : Repair or replace.

STEP 11. Check harness between B-114 (terminal No. 4) cooling fan control relay (LO) connector and A-20 (terminal No. 1) cooling fan motor connector.





NOTE: Before checking harness, check intermediate connector B-109 and repair if necessary.

- Check power supply line for damage.

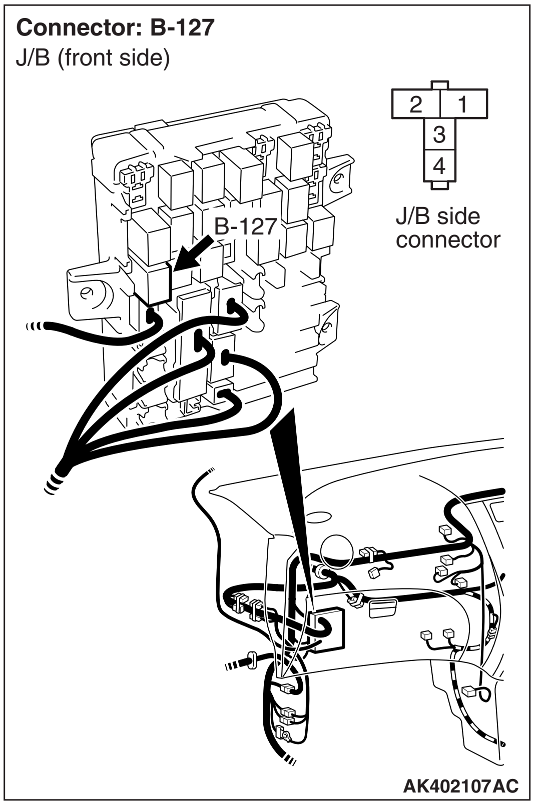
Q: Is the check result normal?

YES : Go to Step 12 .

NO : Repair.

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STEP 12. Connector check: B-127 cooling fan control relay (HI) connector

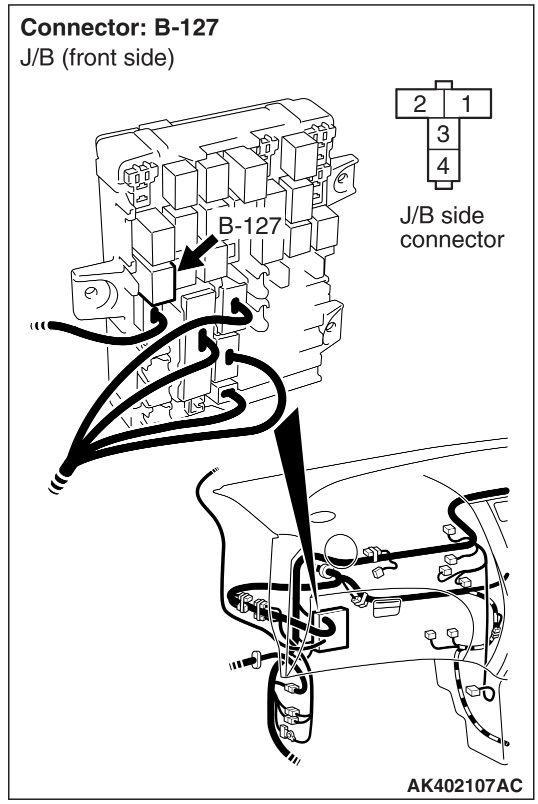


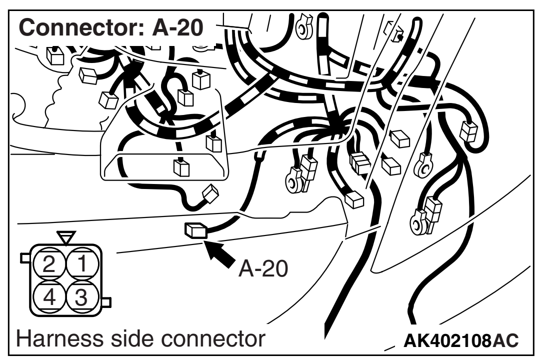
Q: Is the check result normal?

YES : Go to Step 13 .

NO : Repair or replace.

STEP 13. Check harness between B-127 (terminal No. 4) cooling fan control relay (HI) connector and A-20 (terminal No. 3) cooling fan motor connector.





NOTE: Before checking harness, check intermediate connector B-109 and repair if necessary.

- Check power supply line for damage.

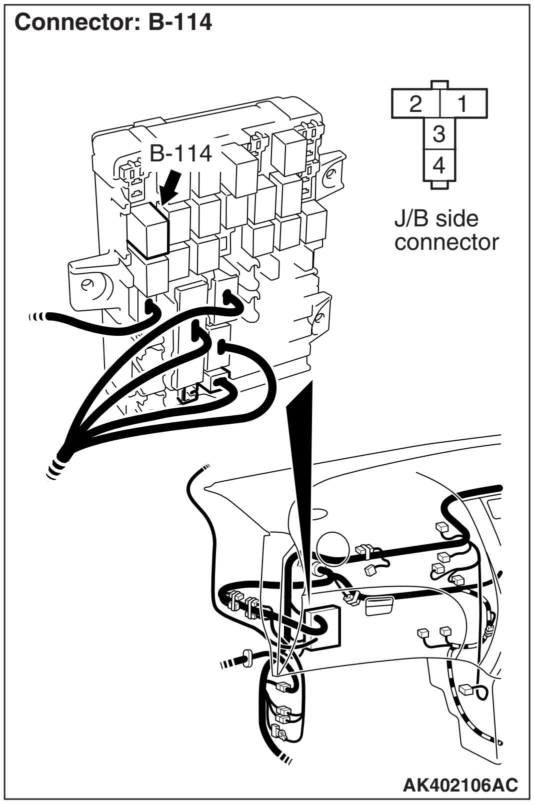
Q: Is the check result normal?

YES : Go to Step 14 .

NO : Repair.

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STEP 14. Check harness between battery and B-114 (terminal No. 3) cooling fan control relay (LO) connector.



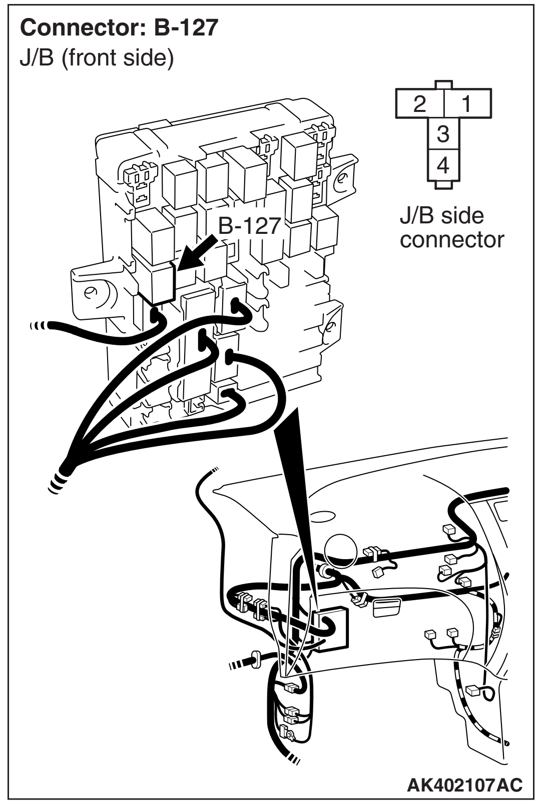
NOTE: Before checking harness, check intermediate connector B-108 and repair if necessary.

- Check power supply line for damage.

Q: Is the check result normal?

YES : Go to Step 15 .
NO : Repair.

STEP 15. Check harness between battery and B-127 (terminal No. 3) cooling fan control relay (HI) connector.



NOTE: Before checking harness, check intermediate connector B-108 and repair if necessary.

- Check power supply line for damage.

Q: Is the check result normal?

YES : Go to Step 16 .
NO : Repair.

STEP 16. Check the trouble symptom.

Q: Does trouble symptom recur?

YES : Replace engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

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Inspection Procedure 20: Poor A/C Performance

COMMENT ON TROUBLE SYMPTOM

- Failure is possibly caused by short/overcharged A/C refrigerant, failed A/C control system, failed fan control system, or other faults.

PROBABLE CAUSES

- Short- or overcharged A/C refrigerant
- Failed A/C compressor relay
- Failed cooling fan control relay
- Failed A/C-ECU
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

Q: Is the diagnosis code output?

YES : Inspection chart for diagnosis code (Refer to P.13B-18).

NO : Go to Step 2 .

STEP 2. Check A/C compressor magnet clutch operation.

- Engine: Idling
- A/C set temperature:
  Maximum Cool when temperature in cabin is 25°C or more
  Maximum Hot when temperature in cabin is 25°C or less

OK:
Magnet clutch active (when A/C is ON)
Magnet clutch inactive (when A/C is OFF)

Q: Is the check result normal?

YES : Go to Step 4 .

NO : Go to Step 3 .

STEP 3. M.U.T.-III data list

- Item 49: A/C relay
  a. Engine: Idling
  b. A/C set temperature:
  Maximum Cool when temperature in cabin is 25°C or more
  Maximum Hot when temperature in cabin is 25°C or less

OK:
ON (when A/C is ON)
OFF (when A/C is OFF)

Q: Is the check result normal?

YES : Check A/C system, Refer to GROUP 55B – Troubleshooting – Check Chart for Diagnosis Code P.55B-3)

NO : Check A/C compressor relay system (Refer to Inspection Procedure 24 P.13B-317).

STEP 4. M.U.T.-III actuator test

- Refer to Actuator Test Reference Table P.13B-344
  a. Item 20: Cooling fan motor (HI)
  b. Item 21: Cooling fan motor (LO)

Q: Are the check results normal?

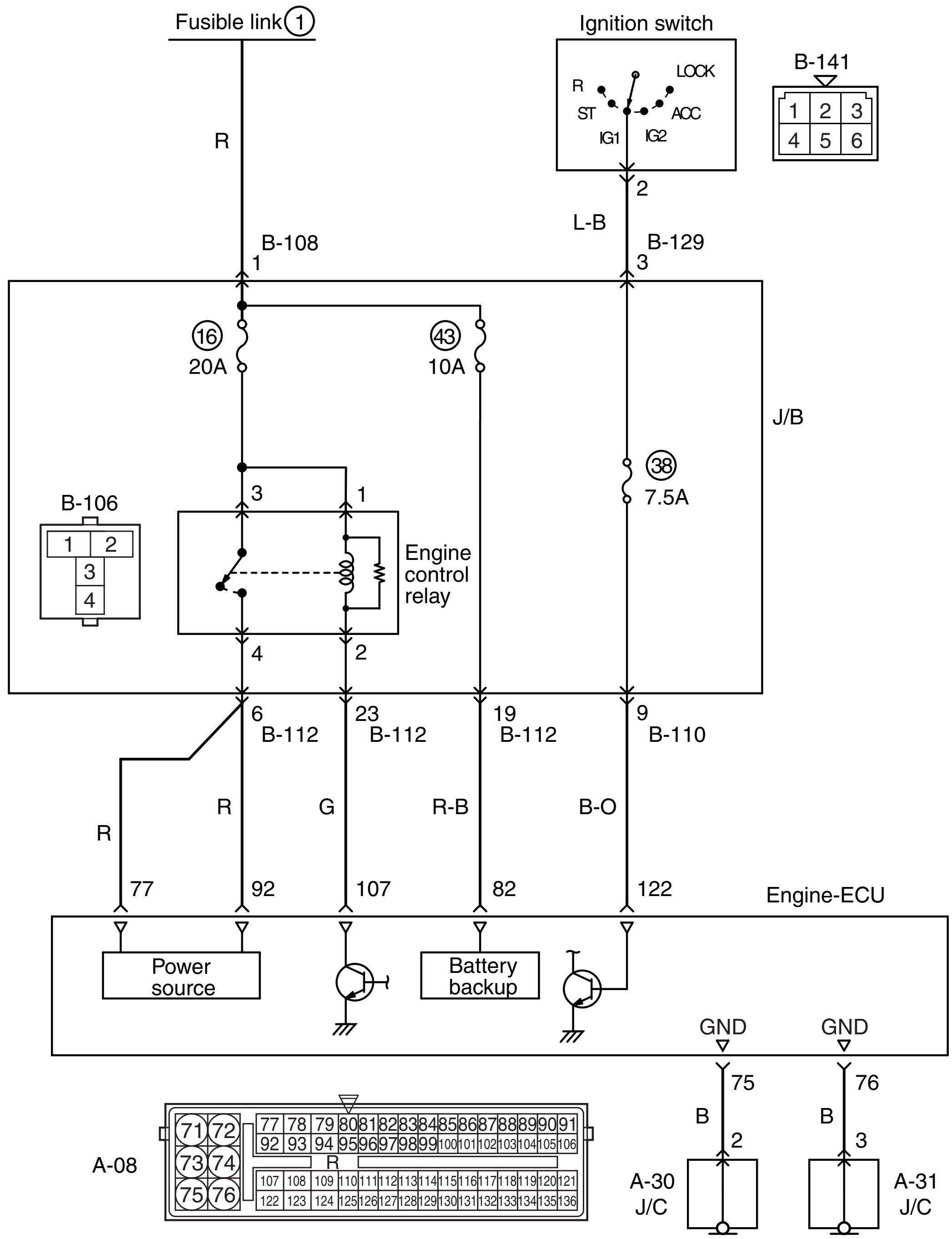
YES : Check charged amount of A/C refrigerant (Refer to GROUP 55A – On-vehicle Service – Check The Refrigerant Level P.55A-50).

NO : Check fan control relay system (Refer to Inspection Procedure 23 P.13B-303).

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Group TOC

Inspection Procedure 21: Engine-ECU Power Supply, Engine Control Relay, Ignition Switch-IG1 System

Power Supply And Ignition Switch-IG Circuit



Wire colour code
B: Black LG: Light green G: Green L: Blue W: White Y: Yellow SB: Sky blue BR: Brown O: Orange GR: Gray
R: Red P: Pink V: Violet P: Purple

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Group TOC

OPERATION

- The battery voltage is applied to the engine control relay (terminal No. 1 and No. 3).
- The engine-ECU (terminal No. 107) makes the power transistor in the unit be ON position and makes currents go on the engine control relay coil, and that makes the relay be in ON position.
- When the engine control relay is in ON position, the battery voltage is supplied to the engine-ECU, the sensor and the actuator from the engine control relay (terminal No. 4).

FUNCTION

- When the ignition switch ON signal is input to the engine-ECU, the engine-ECU places the engine control relay in the ON position. Accordingly, the battery voltage is supplied to the engine-ECU, sensor and actuator.

PROBABLE CAUSES

- Failed battery
- Failed engine control relay
- Failed ignition switch
- Open/short circuit in or damage to the engine control relay circuit or loose connector contact
- Open/short circuit in or damage to the ignition switch-IG1 circuit or loose connector contact
- Open/short circuit in or damage to the engine-ECU circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Check battery voltage.

- Measure battery voltage during cranking.

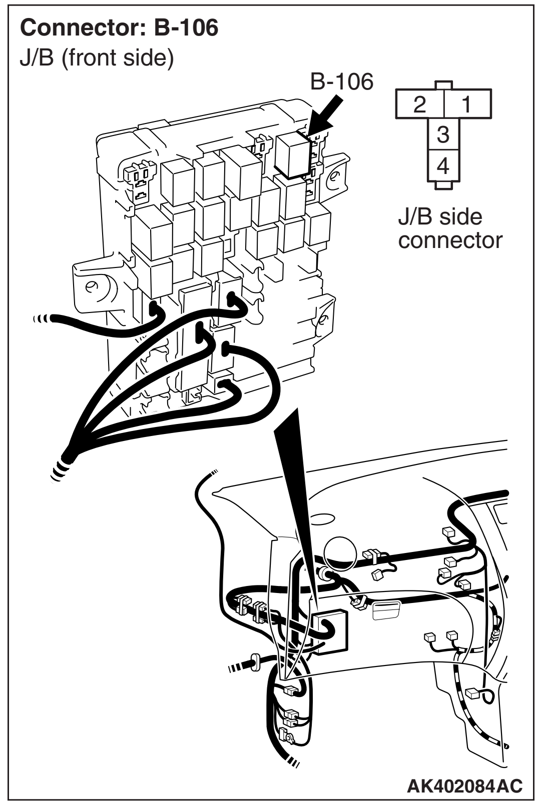
OK: 8 V or more

Q: Is the check result normal?

YES : Go to Step 2 .

NO : Check battery (Refer to GROUP 54A – Battery – On-vehicle Service – Battery Test P.54A-5).

STEP 2. Connector check: B-106 engine control relay connector



Q: Is the check result normal?

YES : Go to Step 3 .

NO : Repair or replace.

STEP 3. Check engine control relay.

- Check engine control relay (Refer to P.13B-363).

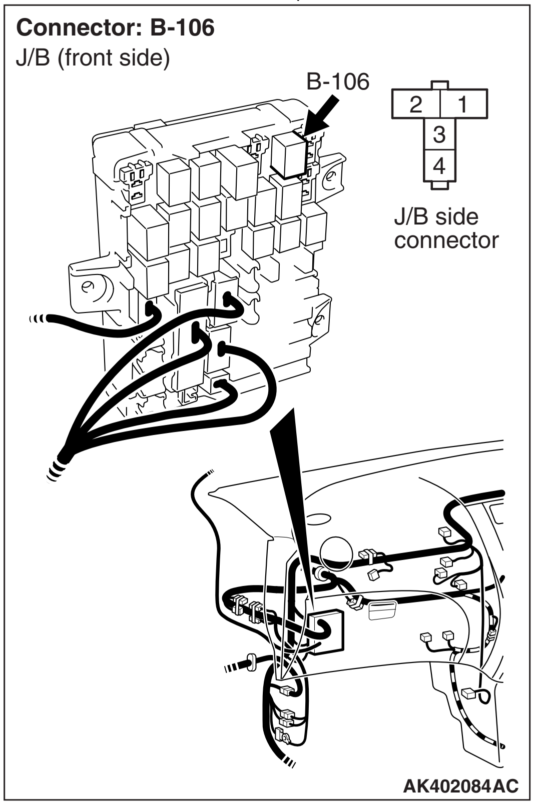
Q: Is the check result normal?

YES : Go to Step 4 .

NO : Replace engine control relay.

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STEP 4. Perform voltage measurement at B-106 engine control relay connector.



Remove relay, and measure at connector side.

- Ignition switch: ON
- Voltage between terminal No. 1 and earth, also between No. 3 and earth.

OK: System voltage

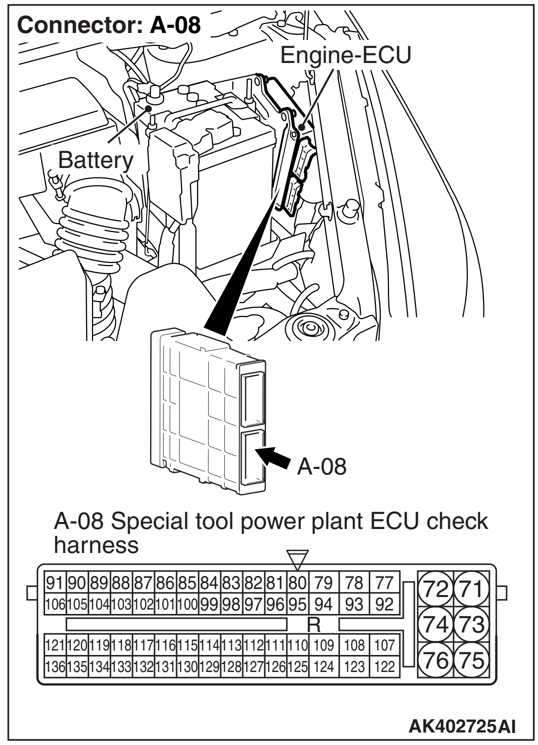
Q: Is the check result normal?

YES : Go to Step 5 .

NO : Check intermediate connector B-108, and repair if necessary. If intermediate connector is normal, check and repair harness between battery and B-106 (terminal No. 1 and No. 3) engine control relay connector.

- Check power supply line for open/short circuit.

STEP 5. Connector check: A-08 engine-ECU connector



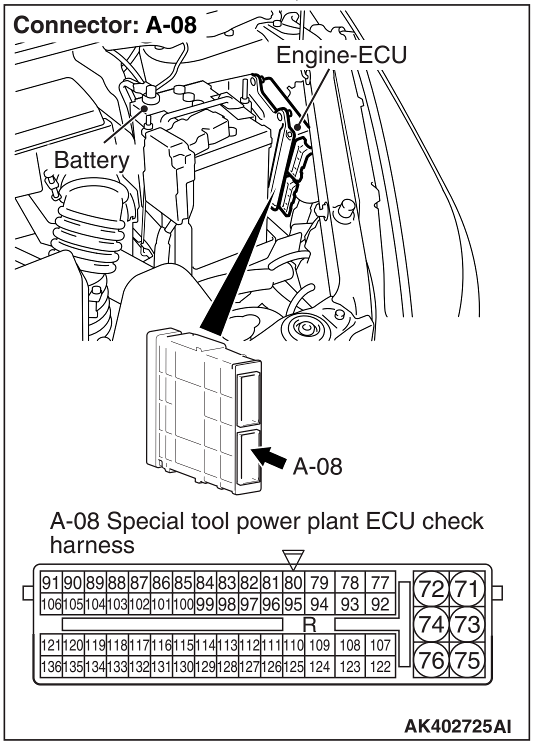
Q: Is the check result normal?

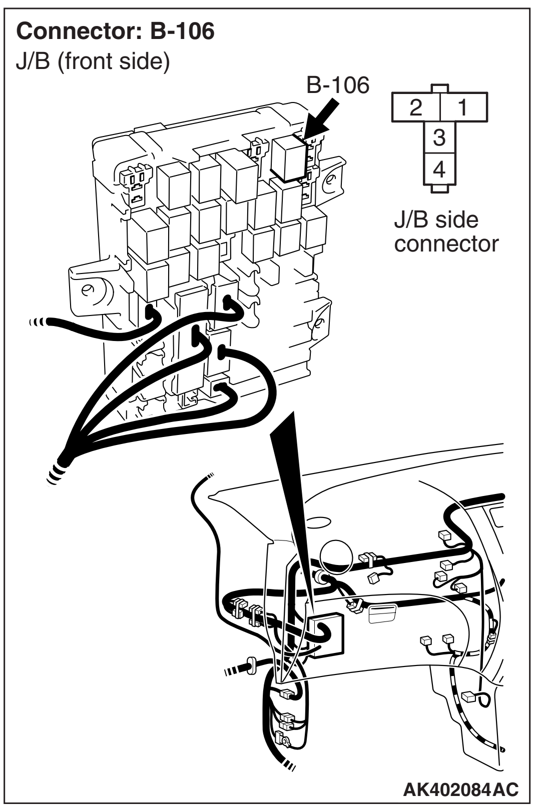
YES : Go to Step 6 .

NO : Repair or replace.

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STEP 6. Perform voltage measurement at A-08 engine-ECU connector.





Disconnect engine-ECU connector, and connect Special Tool Power Plant ECU Check Harness (MB991987), and measure the voltage on the check connector.

- Ignition switch: ON
- Voltage between terminal No. 77 and earth, also between terminal No. 92 and earth.

OK: System voltage

Q: Is the check result normal?

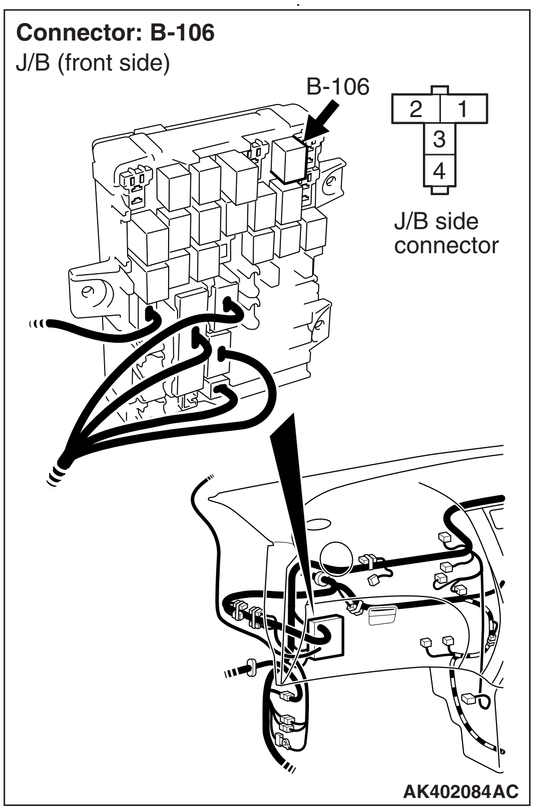
YES : Check intermediate connector B-112, and repair if necessary. If intermediate connector is normal, check and repair harness between B-106 (terminal No. 2) engine control relay connector and A-08 (terminal No. 107) engine-ECU connector.

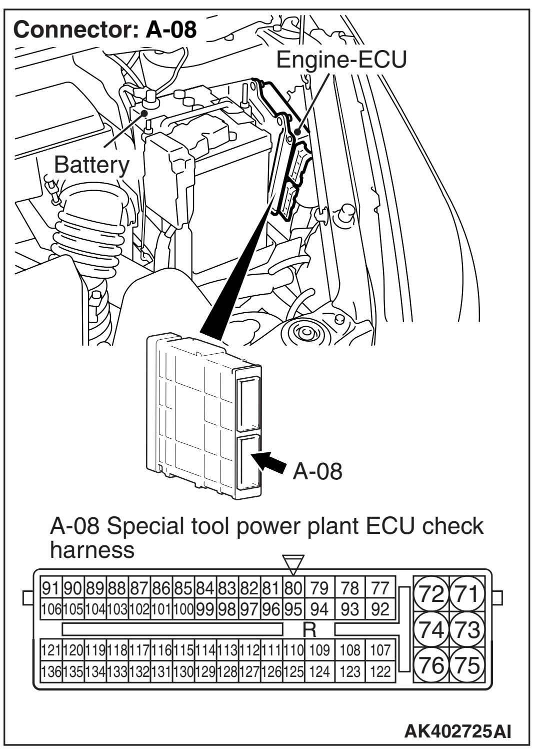
- Check signal line for short circuit.

NO : Go to Step 7 .

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STEP 7. Check harness between B-106 (terminal No. 4) engine control relay connector and A-08 (terminal No. 77 and No. 92) engine-ECU connector.

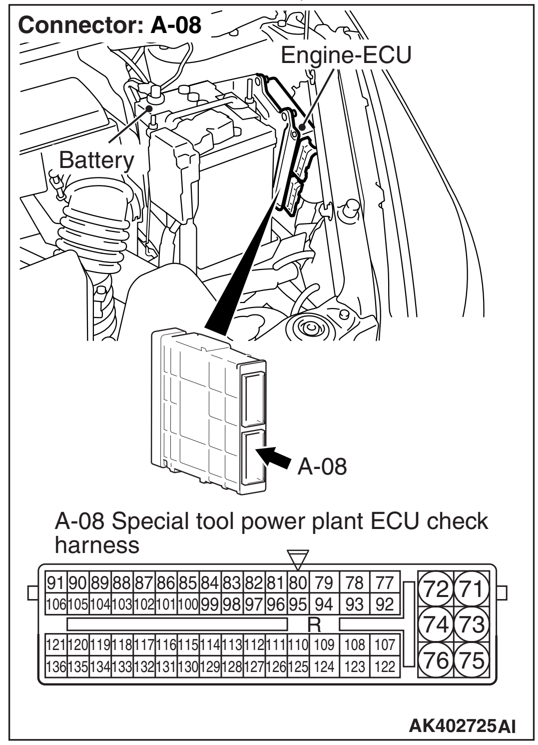




Check power supply line for open/short circuit or damage.

Q: Is the check result normal?
YES : Go to Step 8 .
NO : Repair.

STEP 8. Perform voltage measurement at A-08 engine-ECU connector.



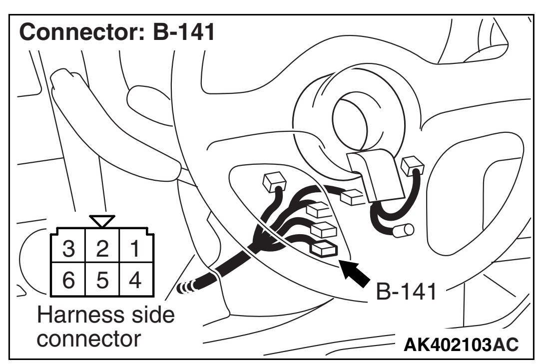
Disconnect connector and measure at harness side.

- Ignition switch: ON
- Voltage between terminal No. 122 and earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 11 .
NO : Go to Step 9 .

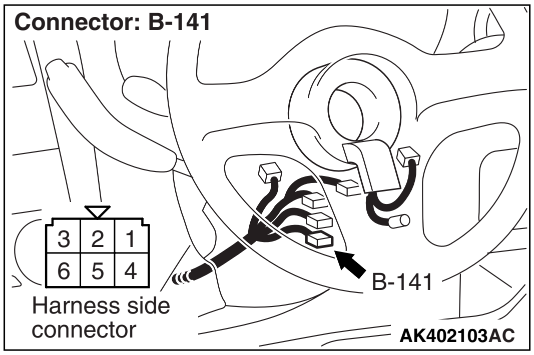
STEP 9. Connector check: B-141 ignition switch connector

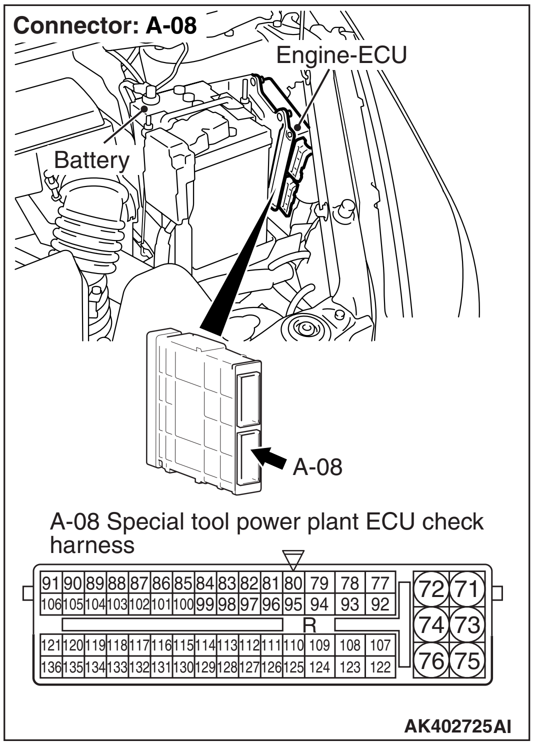


Q: Is the check result normal?
YES : Go to Step 10 .
NO : Repair or replace.

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STEP 10. Check ignition switch.





Check ignition switch (Refer to GROUP 54A – Ignition Switch – Inspection P.54A-27).

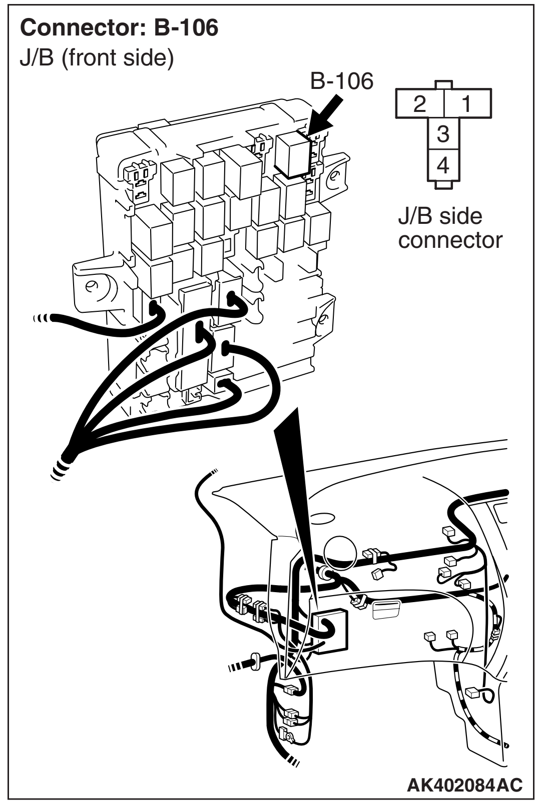
Q: Is the check result normal?

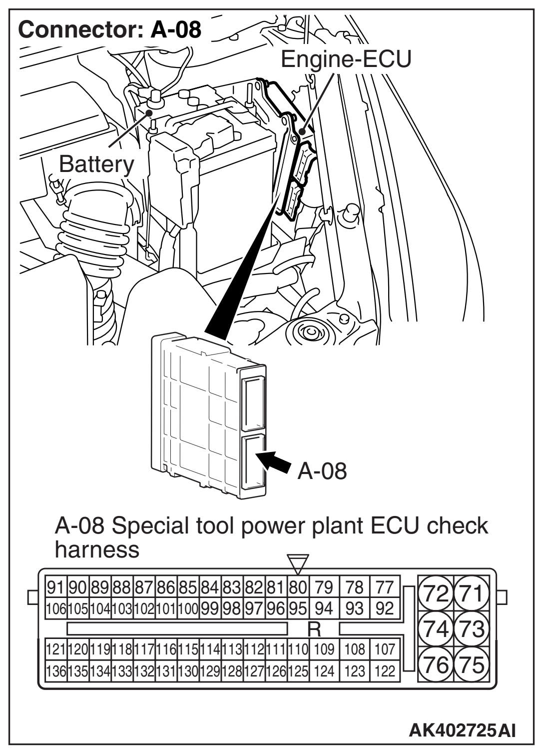
YES : Check intermediate connectors B-110, B-129, and repair if necessary. If intermediate connectors are normal, check and repair harness between B-141 (terminal No. 2) ignition switch connector and A-08 (terminal No. 122) engine-ECU connector.

- Check output line for open/short circuit.

NO : Replace ignition switch.

STEP 11. Check harness between B-106 (terminal No. 2) engine control relay connector and A-08 (terminal No. 107) engine-ECU connector.





NOTE: Before checking harness, check intermediate connector B-112 and repair if necessary.

- Check output line for damage.

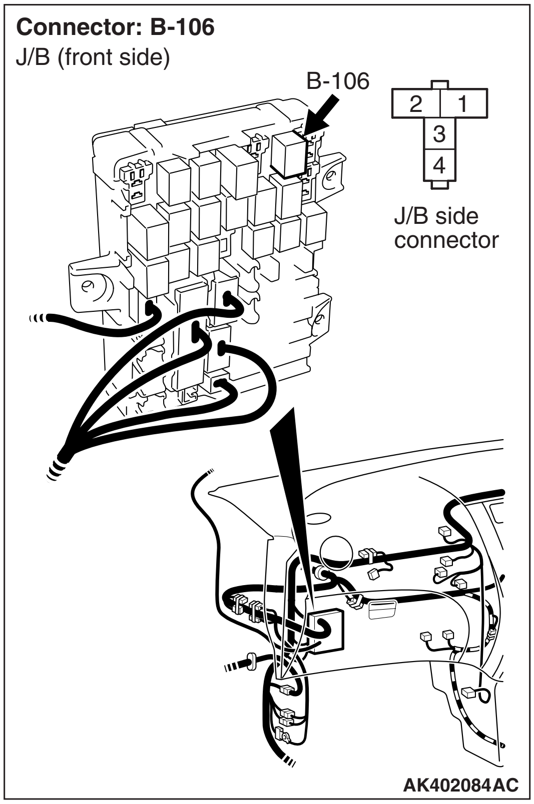
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Q: Is the check result normal?

YES : Go to Step 12 .

NO : Repair.

STEP 12. Check harness between battery and B-106 (terminal No. 1 and No. 3) engine control relay connector.



NOTE: Before checking harness, check intermediate connector B-108 and repair if necessary.

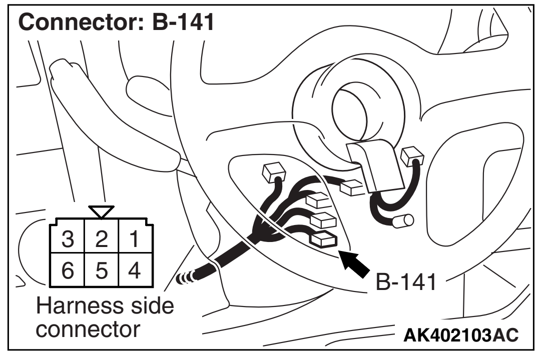
- Check power supply line for damage.

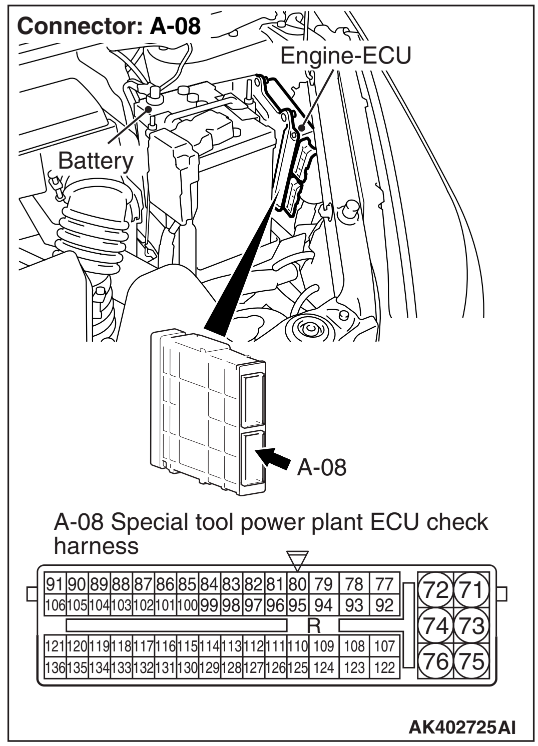
Q: Is the check result normal?

YES : Go to Step 13 .

NO : Repair.

STEP 13. Check harness between B-141 (terminal No. 2) ignition switch connector and A-08 (terminal No. 122) engine-ECU connector.





NOTE: Before checking harness, check intermediate connectors B-110, B-129, and repair if necessary.

- Check output line for damage.

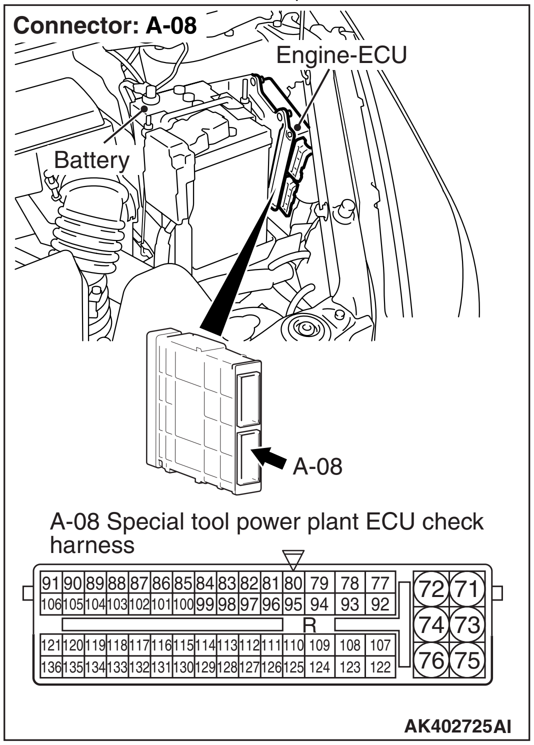
Q: Is the check result normal?

YES : Go to Step 14 .

NO : Repair.

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STEP 14. Check harness between A-08 (terminal No. 75 and No. 76) engine-ECU connector and body earth.



Check earthing line for open circuit and damage.

Q: Is the check result normal?

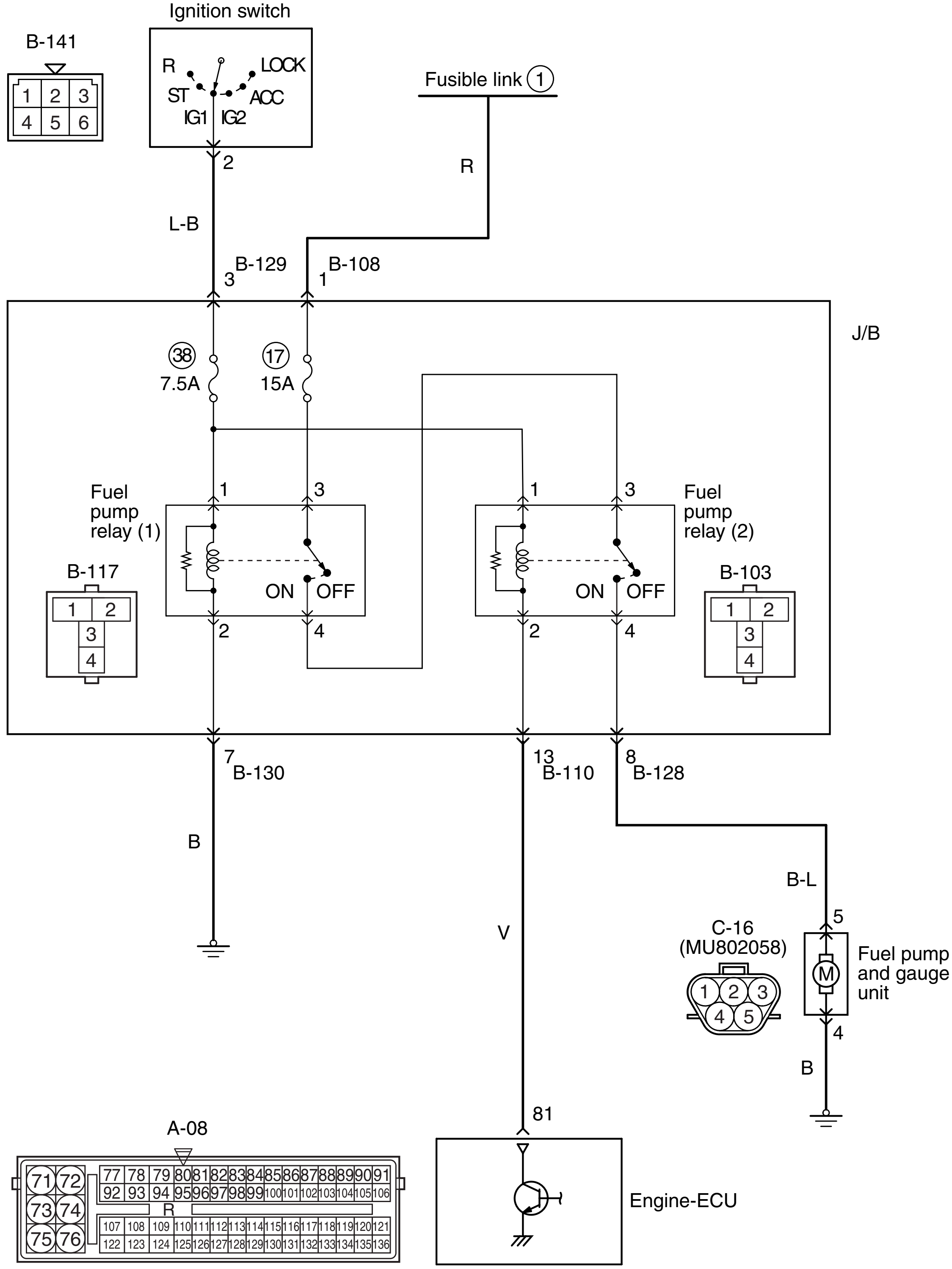
YES : Replace engine-ECU.

NO : Repair.

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Inspection Procedure 22: Fuel Pump System

Fuel Pump Circuit



Wire colour code
B: Black LG: Light green G: Green L: Blue W: White Y: Yellow SB: Sky blue BR: Brown O: Orange GR: Gray
R: Red P: Pink V: Violet P: Purple

AK402703AE

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OPERATION

- The battery voltage is applied to the fuel pump relay (1) (terminal No. 1) from the ignition switch and is earthed to the vehicle body from the fuel pump relay (1) (terminal No. 2).
- The battery voltage is applied to the fuel pump relay (1) (terminal No. 3) and to the fuel pump relay (2) (terminal No. 3) from the fuel pump relay (1) (terminal No. 4).
- The battery voltage is applied to the fuel pump relay (2) (terminal No. 1) from the ignition switch. The engine-ECU (terminal No. 81) makes the power transistor in the unit be in ON position and makes currents go on the fuel pump relay (2) coil, and that makes the relay be in ON position.
- When the fuel pump relay (2) is in ON position, the battery voltage is supplied to the fuel pump from the fuel pump relay (2) (terminal No. 4).

FUNCTION

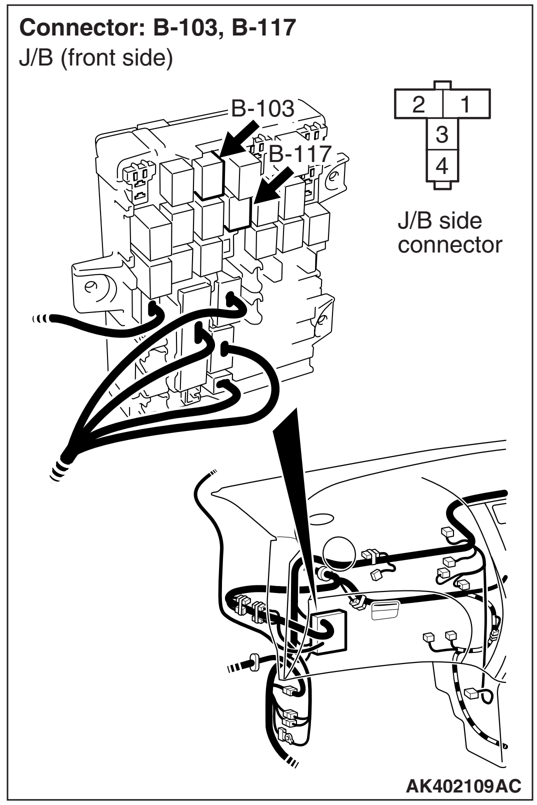
- When the ignition switch ON signal is input to the engine-ECU, the engine-ECU places the fuel pump relay (2) in the ON position. Accordingly, the battery voltage is supplied to the fuel pump.

PROBABLE CAUSES

- Failed fuel pump relay
- Failed fuel pump
- Open/short circuit in or damage to the fuel pump drive circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Connector check: B-103 fuel pump relay (2) connector and B-117 fuel pump relay (1) connector



Q: Is the check result normal?
YES : Go to Step 2 .
NO : Repair or replace.

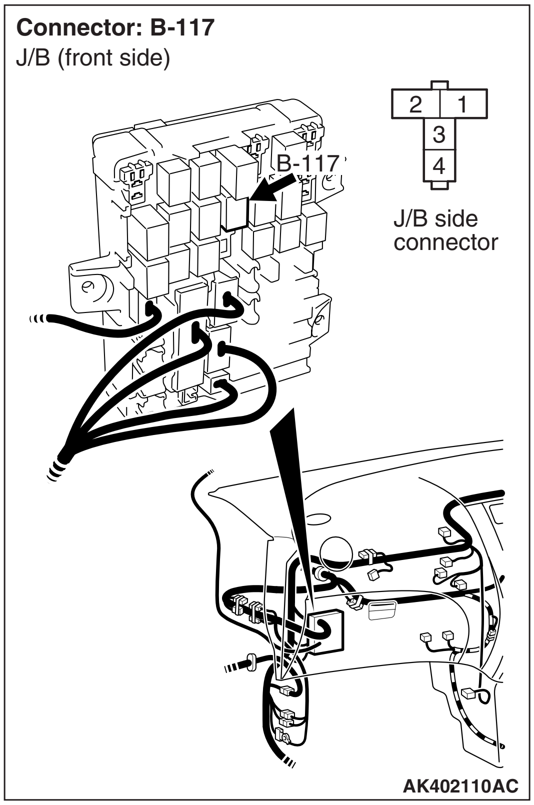
STEP 2. Check fuel pump relay.

- Fuel pump relay, continuity check (Refer to P.13B-363).

Q: Is the check result normal?
YES : Go to Step 3 .
NO : Replace fuel pump relay.

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STEP 3. Perform resistance measurement at B-117 fuel pump relay (1) connector.



- Remove relay, and measure at connector side.
- Resistance between terminal No. 2 and earth.

OK: Continuity (2 Ω or less)

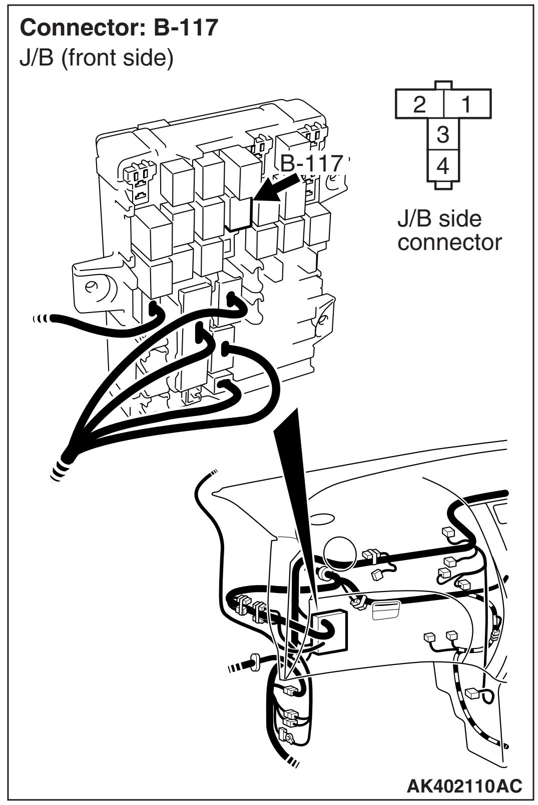
Q: Is the check result normal?

YES : Go to Step 4 .

NO : Check intermediate connector B-130, and repair if necessary. If intermediate connector is normal, check and repair harness between B-117 (terminal No. 2) fuel pump relay (1) connector and body earth.

- Check earthing line for open circuit and damage.

STEP 4. Perform voltage measurement at B-117 fuel pump relay (1) connector.



- Remove relay, and measure at connector side.
- Ignition switch: ON
- Voltage between terminal No. 1 and earth.

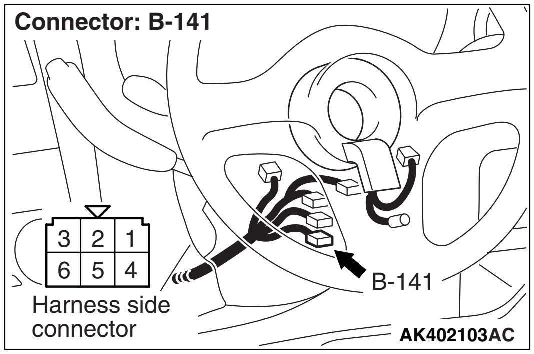
OK: System voltage

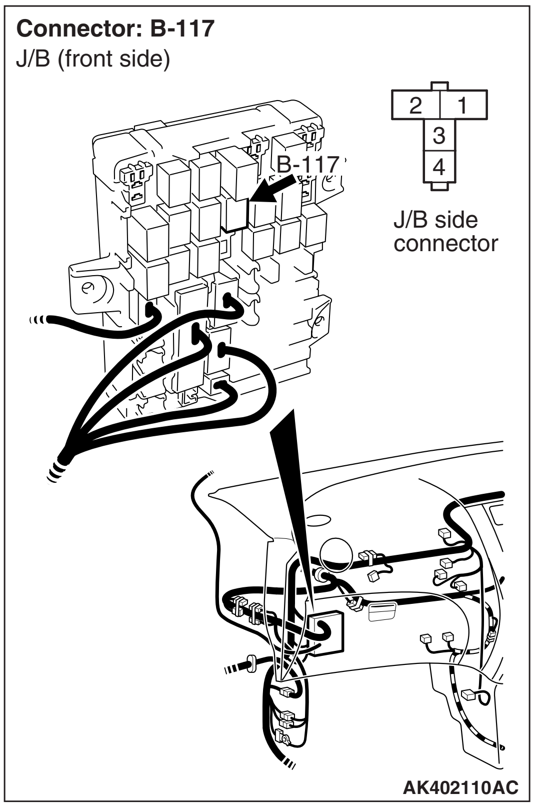
Q: Is the check result normal?

YES : Go to Step 6 .

NO : Go to Step 5 .

STEP 5. Connector check: B-141 ignition switch connector





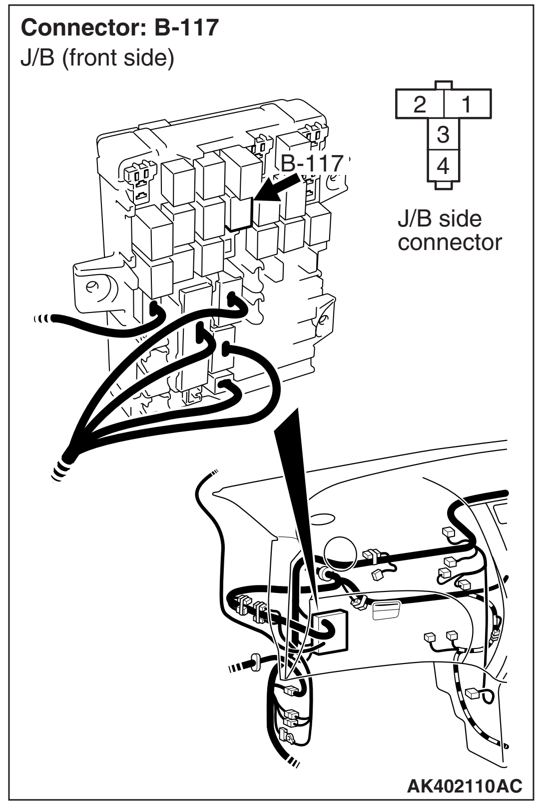
Q: Is the check result normal?

YES : Check intermediate connector B-129, and repair if necessary. If intermediate connector is normal, check and repair harness between B-117 (terminal No. 1) fuel pump relay (1) connector and B-141 (terminal No. 2) ignition switch connector.

- Check power supply line for open/short circuit.

NO : Repair or replace.

STEP 6. Perform voltage measurement at B-117 fuel pump relay (1) connector.



- Remove relay, and measure at connector side.
- Voltage between terminal No. 3 and earth.

OK: System voltage

Q: Is the check result normal?

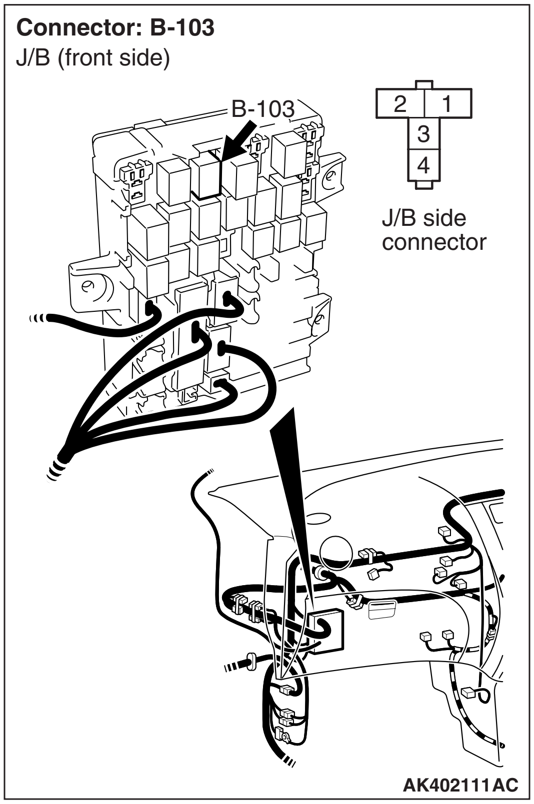
YES : Go to Step 7 .

NO : Check intermediate connector B-108, and repair if necessary. If intermediate connector is normal, check and repair harness between battery and B-117 (terminal No. 3) fuel pump relay (1) connector.

- Check power supply line for open/short circuit.

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STEP 7. Perform resistance measurement at B-103 fuel pump relay (2) connector.



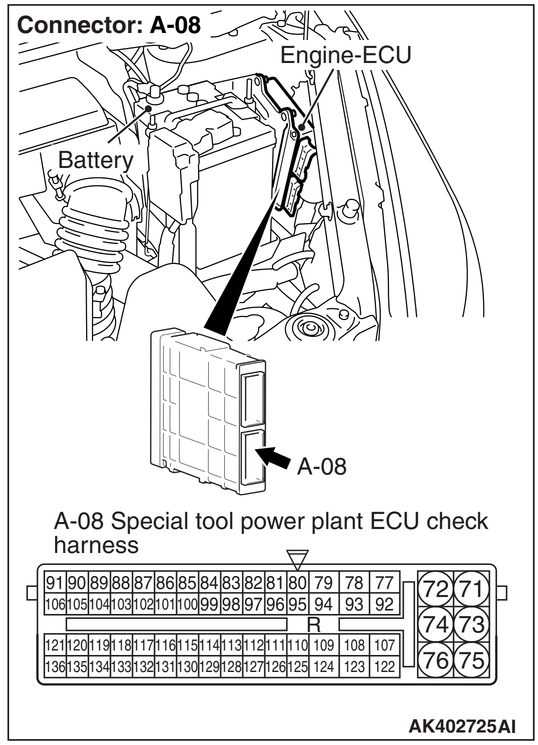
- Remove relay, and measure at connector side.
- Ignition switch: ON
- Resistance between terminal No. 2 and earth.

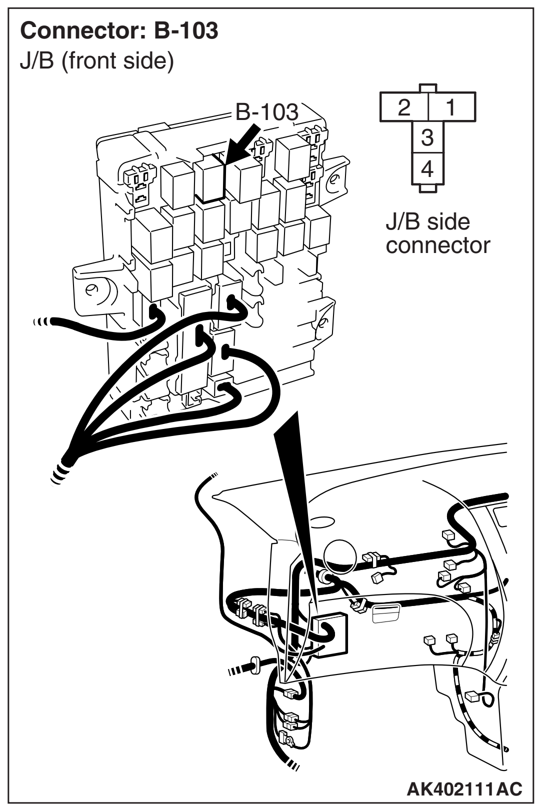
OK: Continuity

Q: Is the check result normal?

YES : Go to Step 9 .
NO : Go to Step 8 .

STEP 8. Connector check: A-08 engine-ECU connector





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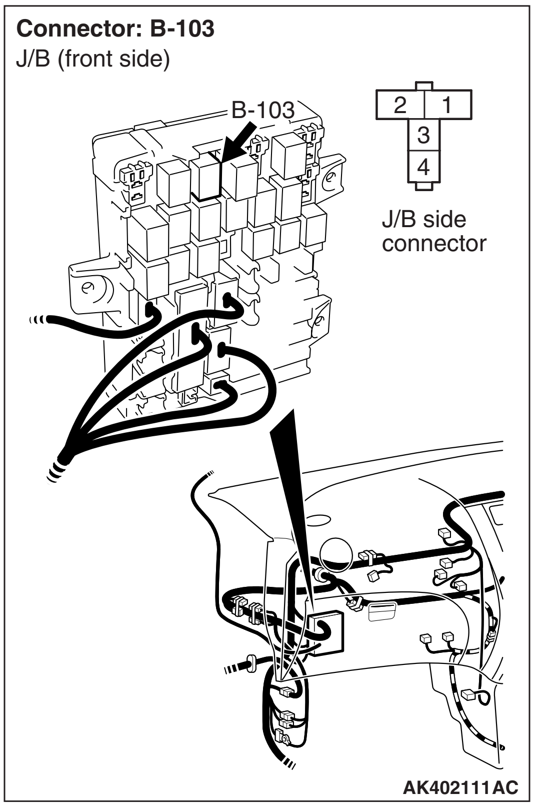
Q: Is the check result normal?

YES : Check intermediate connector B-110, and repair if necessary. If the intermediate connector is normal, check and repair harness between B-103 (terminal No. 2) fuel pump relay (2) connector and A-08 (terminal No. 81) engine-ECU connector.

- Check earthing line for open/short circuit.

NO : Repair or replace.

STEP 9. Perform voltage measurement at B-103 fuel pump relay (2) connector.



- Remove relay, and measure at connector side.
- Ignition switch: ON
- Voltage between terminal No. 1 and earth.

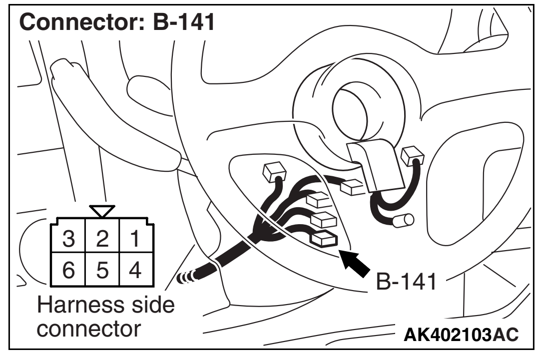
OK: System voltage

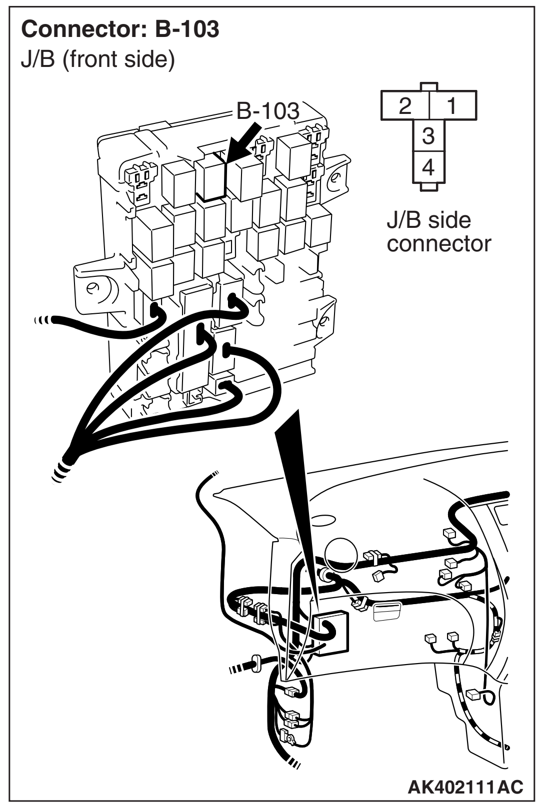
Q: Is the check result normal?

YES : Go to Step 11 .

NO : Go to Step 10 .

STEP 10. Connector check: B-141 ignition switch connector





Q: Is the check result normal?

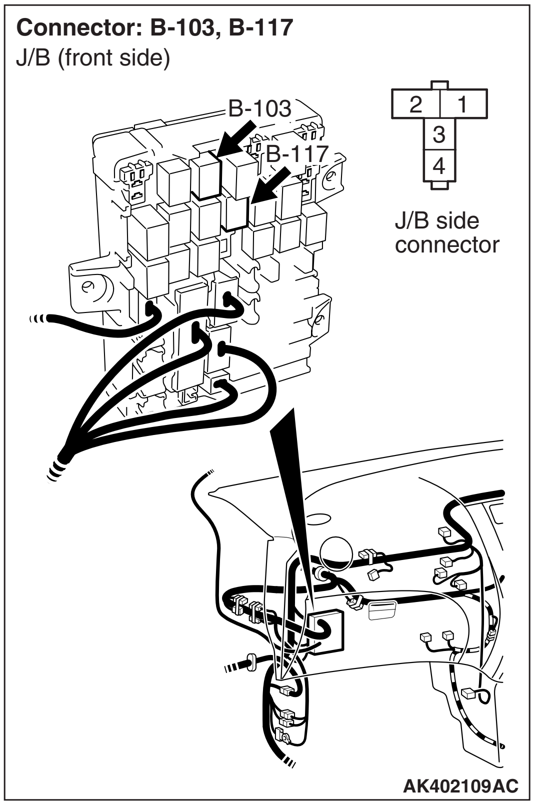
YES : Check intermediate connector B-129, and repair if necessary. If the intermediate connector is normal, check and repair harness between B-103 (terminal No. 1) fuel pump relay (2) connector and B-141 (terminal No. 2) ignition switch connector.

- Check power supply line for open/short circuit.

NO : Repair or replace.

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STEP 11. Perform voltage measurement at B-103 fuel pump relay (2) connector.



- Disconnect relay, and measure at connector side.
- Ignition switch: ON
- Voltage between terminal No. 3 and earth.

OK: System voltage

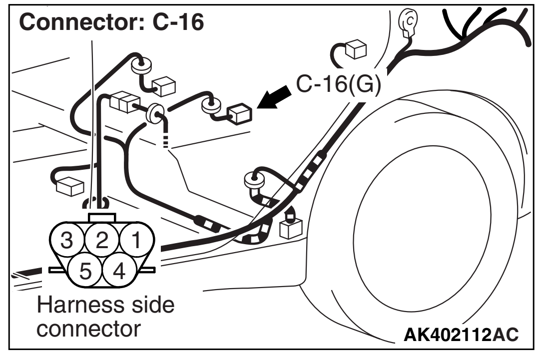
Q: Is the check result normal?

YES : Go to Step 12 .

NO : Check and repair harness between B-117 (terminal No. 4) fuel pump relay (1) connector and B-103 (terminal No. 3) fuel pump relay (2) connector.

- Check power supply line for open/short circuit.

STEP 12. Connector check: C-16 fuel pump connector

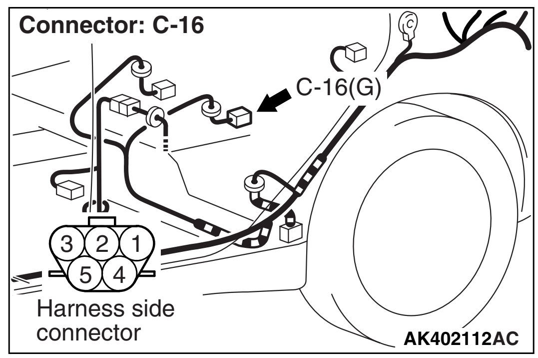


Q: Is the check result normal?

YES : Go to Step 13 .

NO : Repair or replace.

STEP 13. Perform resistance measurement at C-16 fuel pump connector.



- Disconnect connector and measure at harness side.
- Resistance between terminal No. 4 and earth.

OK: Continuity (2 Ω or less)

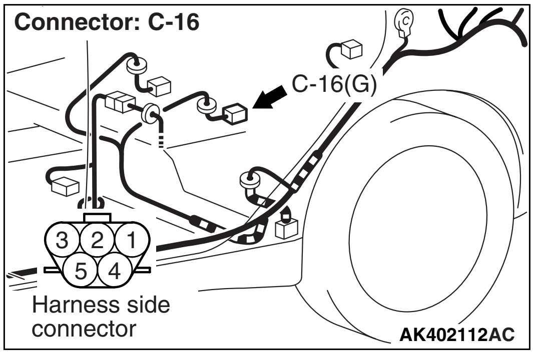
Q: Is the check result normal?

YES : Go to Step 16 .

NO : Go to Step 14 .

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STEP 14. Check harness between C-16 (terminal No. 4) fuel pump connector and body earth.



- Check earthing line for open circuit and damage.

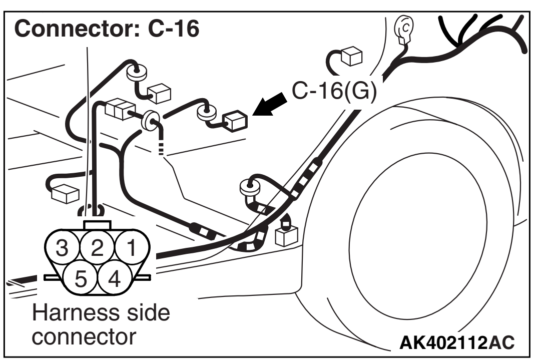
Q: Is the check result normal?
YES : Go to Step 15 .
NO : Repair.

STEP 15. M.U.T.-III actuator test

- Refer to Actuator Test Reference Table P.13B-344.
  a. Item 07: Fuel pump relay

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).
NO : Replace engine-ECU.

STEP 16. Perform voltage measurement at C-16 fuel pump connector.

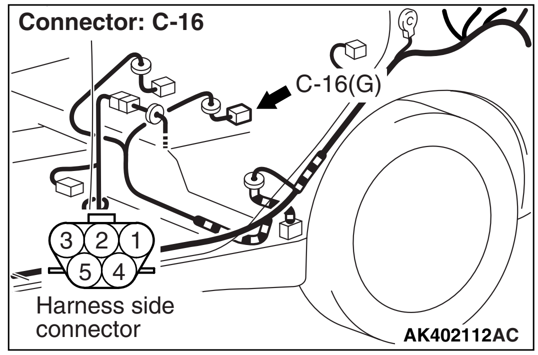


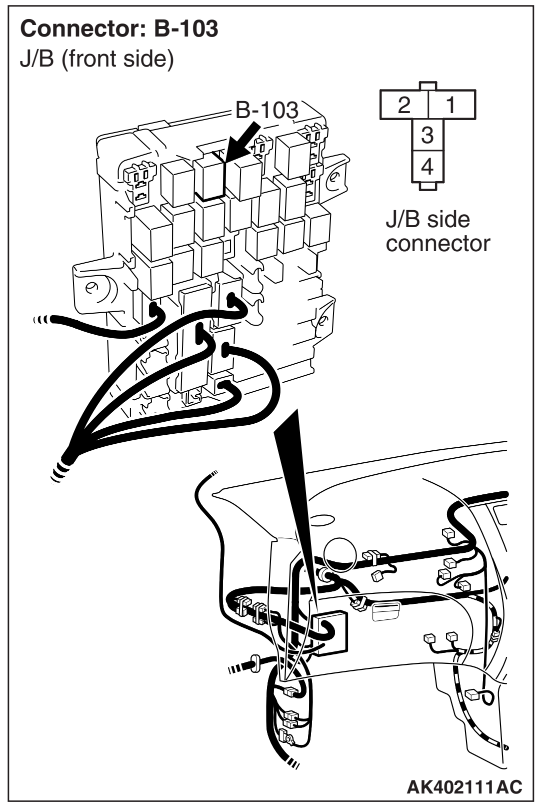
- Disconnect connector and measure at harness side.
- Ignition switch: ON
- Voltage between terminal No. 5 and earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 21 .
NO : Go to Step 17 .

STEP 17. Check harness between C-16 (terminal No. 5) fuel pump connector and B-103 (terminal No. 4) fuel pump relay (2) connector.





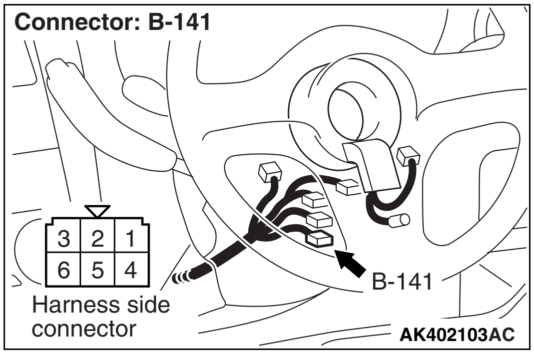
NOTE: Before checking harness, check intermediate connector B-128 and repair if necessary.

- Check output line for open/short circuit.

Q: Is the check result normal?
YES : Go to Step 18 .
NO : Repair.

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STEP 18. Connector check: B-141 ignition switch connector

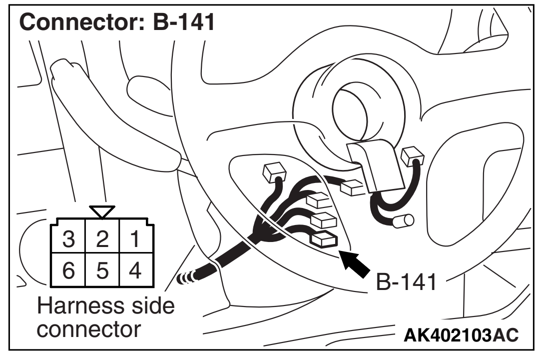


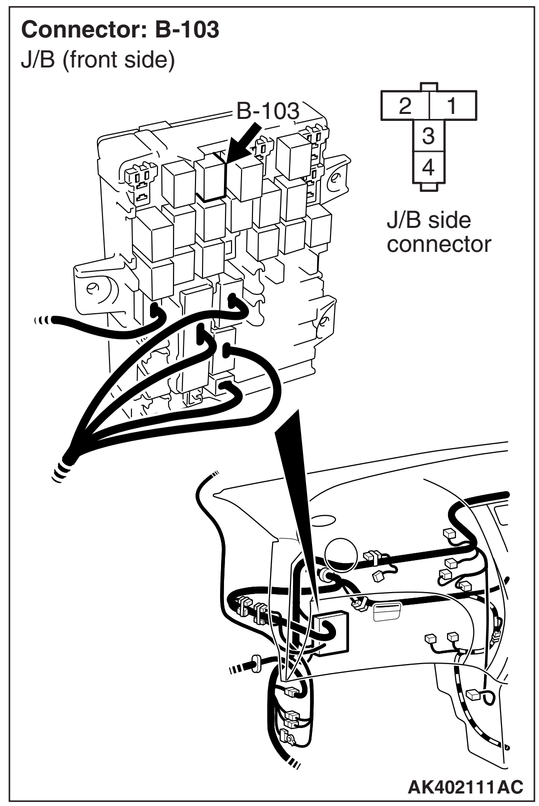
Q: Is the check result normal?

YES : Go to Step 19 .

NO : Repair or replace.

STEP 19. Check harness between B-141 (terminal No. 2) ignition switch connector and B-103 (terminal No. 1) fuel pump relay (2) connector.





NOTE: Before checking harness, check intermediate connector B-129 and repair if necessary.

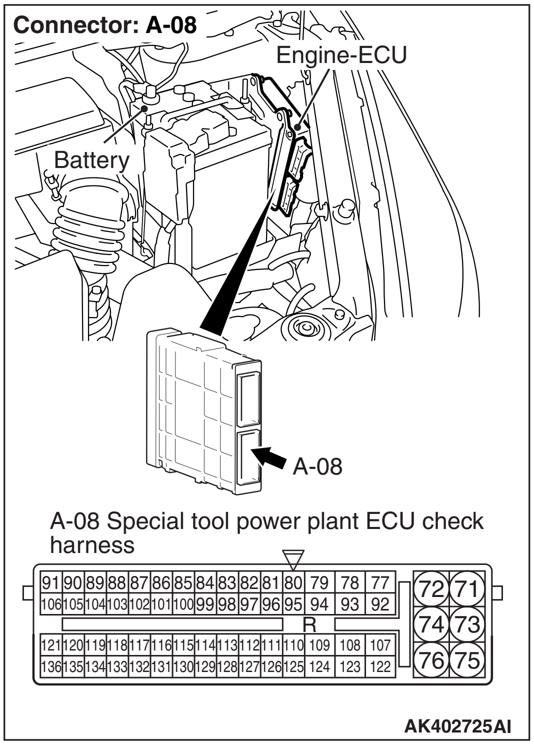
- Check power supply line for damage.

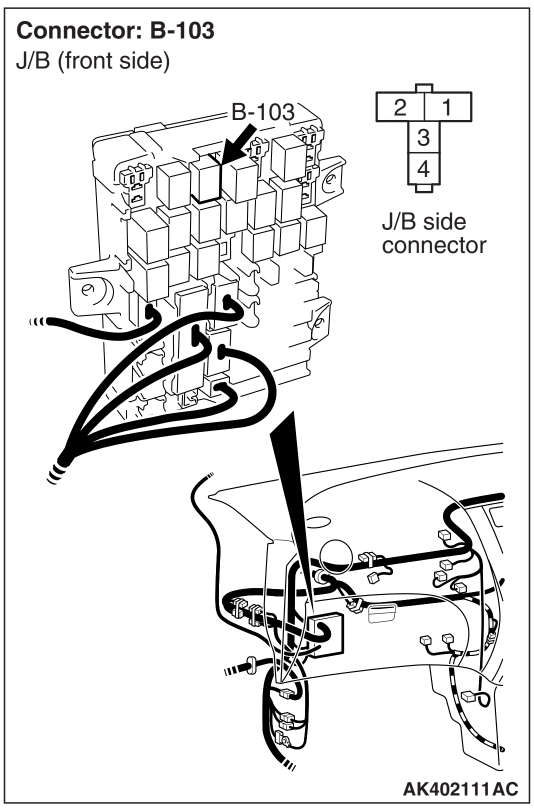
Q: Is the check result normal?

YES : Go to Step 20 .

NO : Repair.

STEP 20. Connector check: A-08 engine-ECU connector





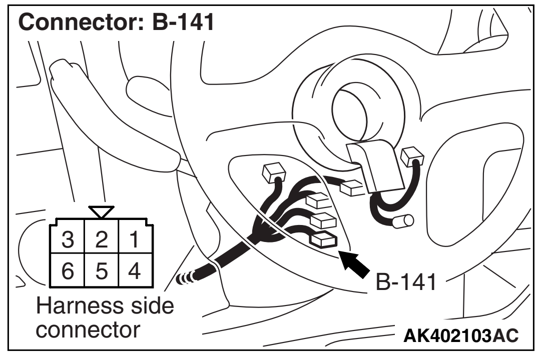
Q: Is the check result normal?

YES : Check intermediate connector B-110, and repair if necessary. If the intermediate connector is normal, check and repair harness between B-103 (terminal No. 2) fuel pump relay (2) connector and A-08 (terminal No. 81) engine-ECU connector.

- Check earthing line for damage.

NO : Repair or replace.

STEP 21. Connector check: B-141 ignition switch connector



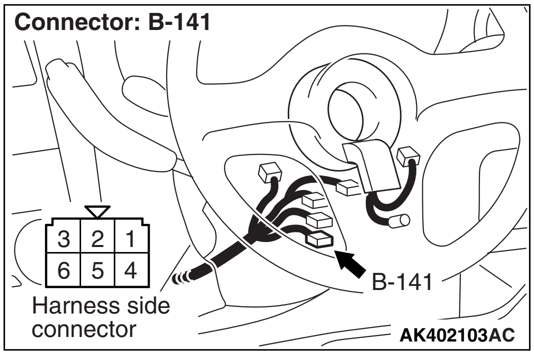
Q: Is the check result normal?

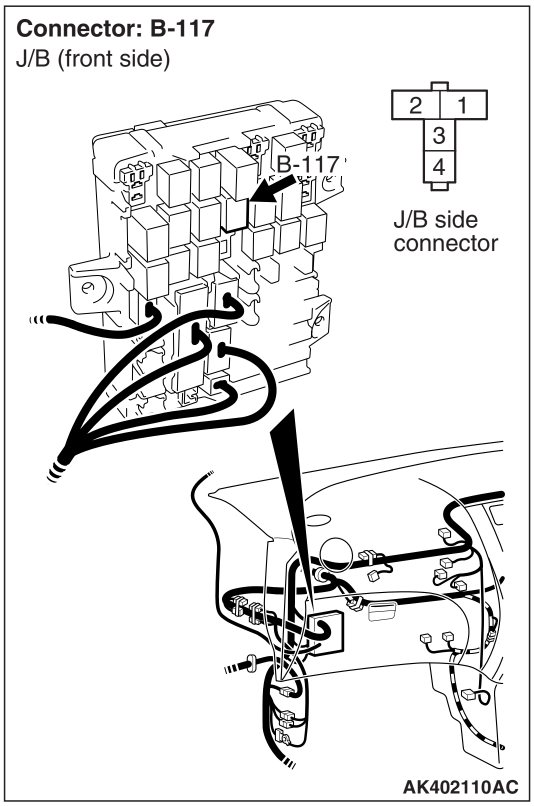
YES : Go to Step 22 .

NO : Repair or replace.

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STEP 22. Check harness between B-141 (terminal No. 2) ignition switch connector and B-117 (terminal No. 1) fuel pump relay (1) connector.





NOTE: Before checking harness, check intermediate connector B-129 and repair if necessary.

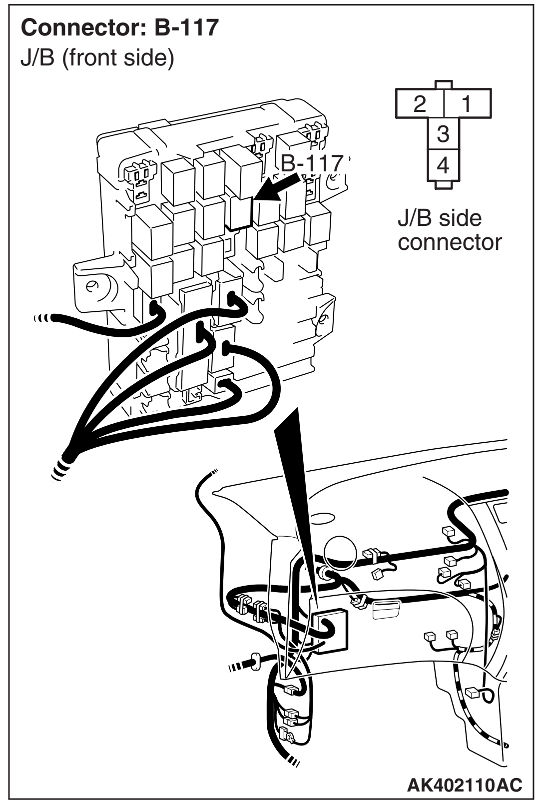
- Check power supply line for damage.

Q: Is the check result normal?

YES : Go to Step 23 .

NO : Repair.

STEP 23. Check harness between battery and B-117 (terminal No. 3) fuel pump relay (1) connector.



NOTE: Before checking harness, check intermediate connector B-108 and repair if necessary.

- Check power supply line for damage.

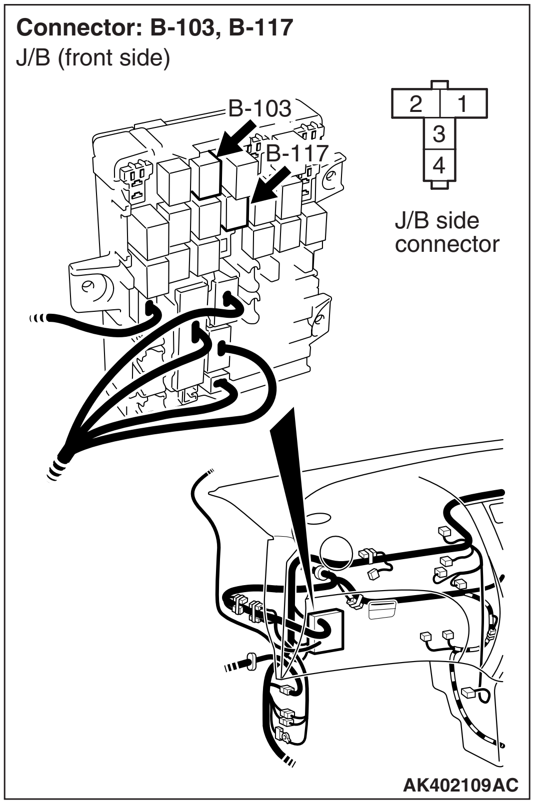
Q: Is the check result normal?

YES : Go to Step 24 .

NO : Repair.

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STEP 24. Check harness between B-117 (terminal No. 4) fuel pump relay (1) connector and B-103 (terminal No. 3) fuel pump relay (2) connector.



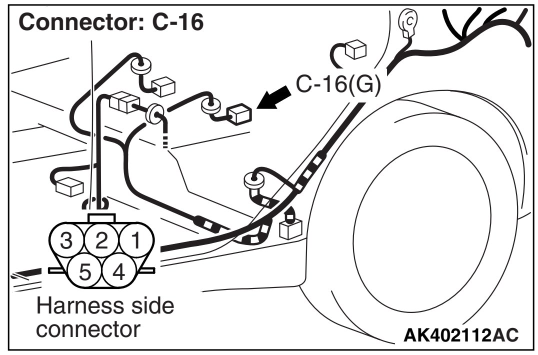
- Check power supply line for damage.

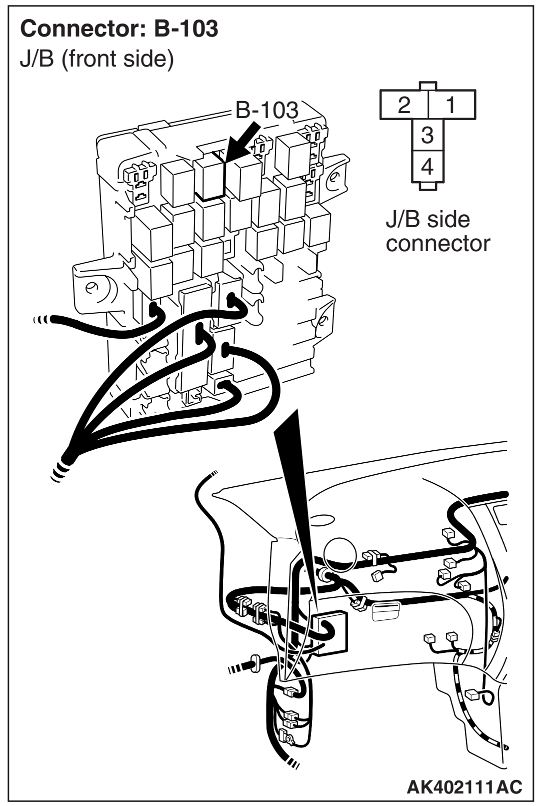
Q: Is the check result normal?

YES : Go to Step 25 .

NO : Repair.

STEP 25. Check harness between C-16 (terminal No. 5) fuel pump connector and B-103 (terminal No. 4) fuel pump relay (2) connector.





NOTE: Before checking harness, check intermediate connector B-128 and repair if necessary.

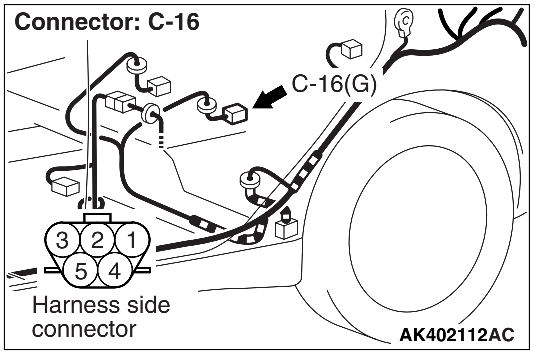
- Check output line for damage.

Q: Is the check result normal?

YES : Go to Step 26 .

NO : Repair.

STEP 26. Check harness between C-16 (terminal No. 4) fuel pump connector and body earth.



- Check earthing line for damage.

Q: Is the check result normal?

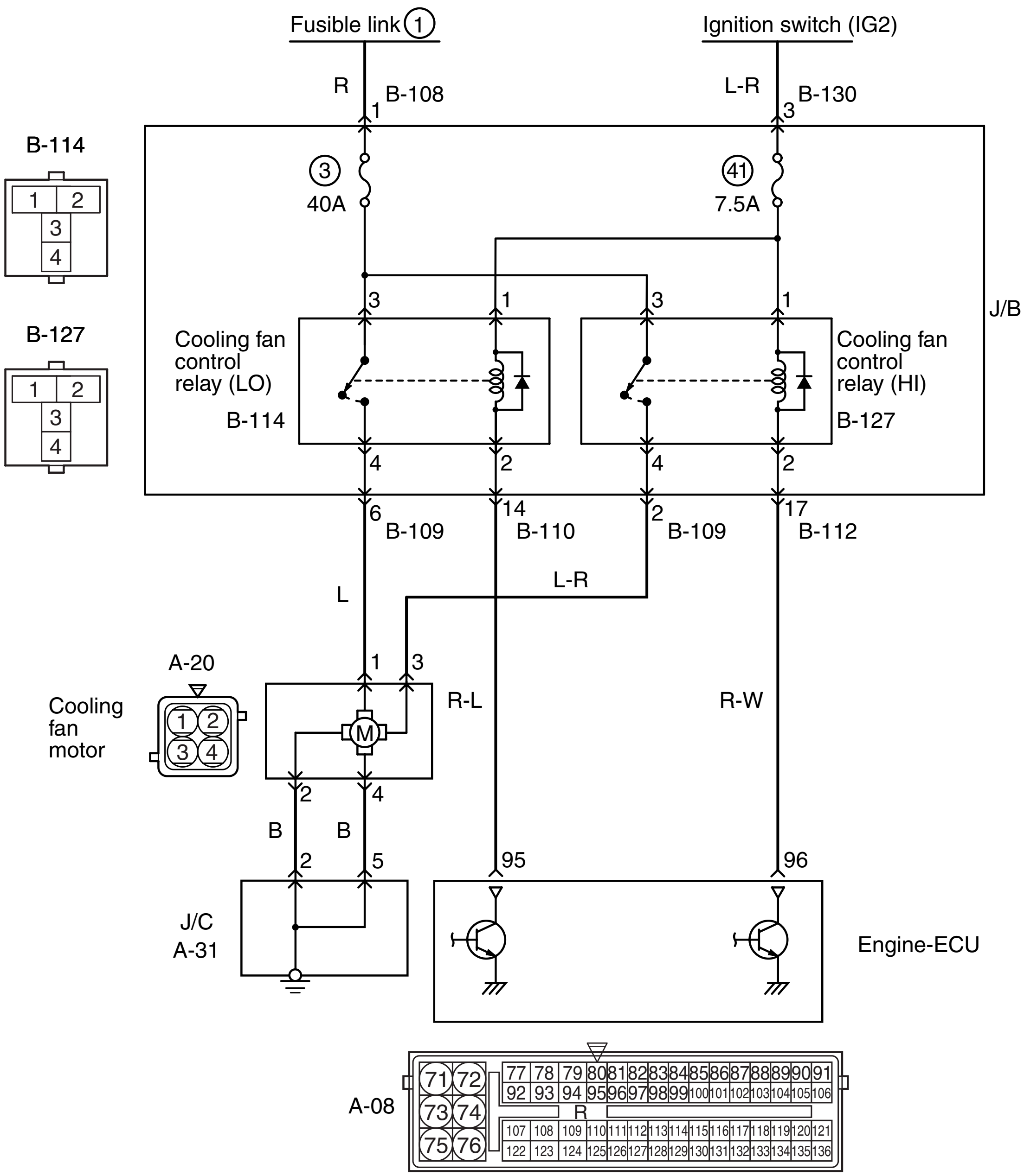
YES : Replace fuel pump.

NO : Repair.

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Group TOC

Inspection Procedure 23: Fan Control Relay System

Cooling Fan Control Relay Circuit



Wire colour code
B: Black LG: Light green G: Green L: Blue W: White Y: Yellow SB: Sky blue BR: Brown O: Orange GR: Gray
R: Red P: Pink V: Violet P: Purple

AK402838AC

OPERATION

- The battery voltage is applied to the cooling fan control relay (LO) coil (terminal No. 1) and cooling fan control relay (HI) coil (terminal No. 1) from the ignition switch.
- The engine-ECU (terminal No. 95 and No. 96) turns on the switch of the power transistor on the unit, and then turns on the switch of the relay by applying the electrical current to the cooling fan control relay (LO) coil or cooling fan control relay (HI) coil.

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- When the cooling fan control relay (LO) is in ON position, the battery voltage is applied to the cooling fan motor (terminal No. 1) from the cooling fan control relay (LO) (terminal No. 4).
- When the cooling fan control relay (LO) and cooling fan control relay (HI) are in ON position, the battery voltage is applied to the cooling fan motor (terminal No. 3) from the cooling fan control relay (HI) (terminal No. 4).

FUNCTION

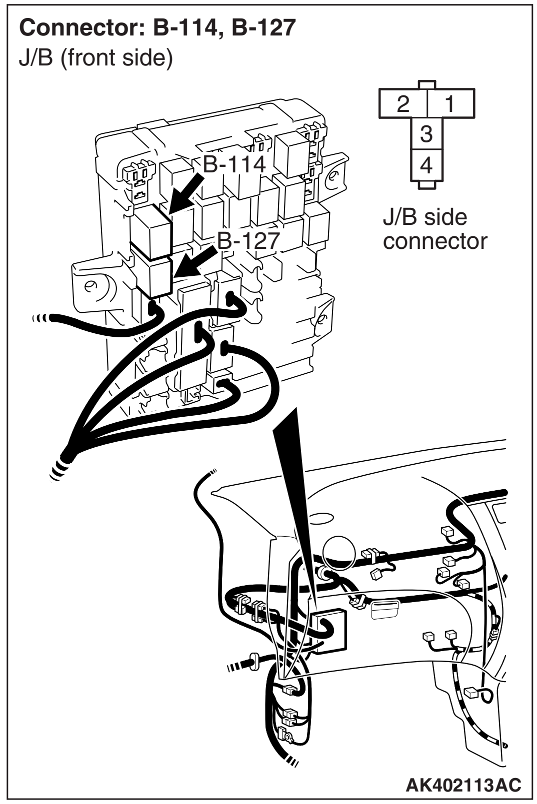
- When the cooling fan control relay (LO) is in ON position, the fan motor rotates with the low speed.
- When the cooling fan control relay (LO) and the cooling fan control relay (HI) are in ON position, the fan motor rotates with the high speed.

PROBABLE CAUSES

- Failed cooling fan control relay
- Failed cooling fan motor
- Open/short circuit in or damage to the cooling fan control relay circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Connector check: B-114 cooling fan control relay (LO) connector, B-127 cooling fan control relay (HI) connector



Q: Is the check result normal?
YES : Go to Step 2 .
NO : Repair or replace.

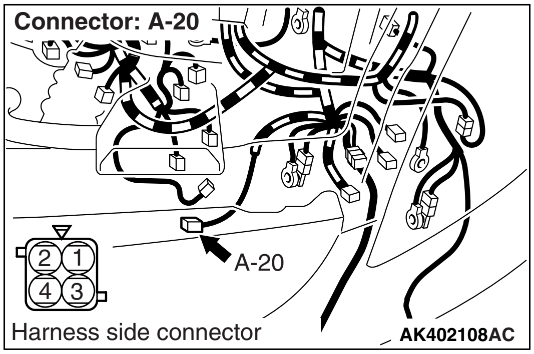
STEP 2. Check cooling fan control relay (LO) and cooling fan control relay (HI).

- Check cooling fan control relay (Refer to GROUP 14 – On-vehicle Service – Fan Control Relay Continuity Check P.14-8).

Q: Is the check result normal?
YES : Go to Step 3 .
NO : Replace cooling fan control relay.

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STEP 3. Connector check: A-20 cooling fan motor connector



Q: Is the check result normal?

YES : Go to Step 4 .

NO : Repair or replace.

STEP 4. Check cooling fan motor itself.

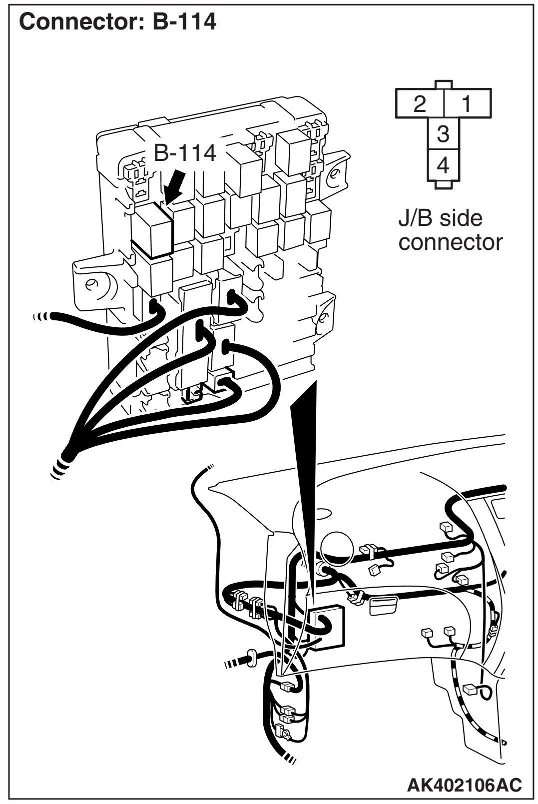
- Check cooling fan motor (Refer to GROUP 14 – On-vehicle Service – Cooling Fan Motor Inspection P.14-9).

Q: Is the check result normal?

YES : Go to Step 5 .

NO : Replace fan motor.

STEP 5. Perform voltage measurement at B-114 cooling fan control relay (LO) connector.



Disconnect connector and measure at harness side.

- Voltage between terminal No. 3 and earth.

OK: System voltage

Q: Is the check result normal?

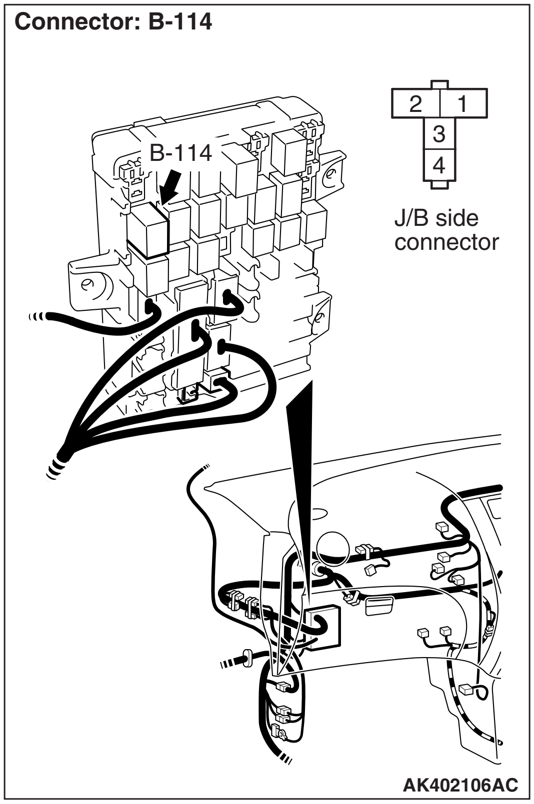
YES : Go to Step 6 .

NO : Check intermediate connector B-108, and repair if necessary. If intermediate connector is normal, check and repair harness between battery and B-114 (terminal No. 3) cooling fan control relay (LO) connector.

- Check power supply line for open/short circuit.

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STEP 6. Perform voltage measurement at B-114 cooling fan control relay (LO) connector.



Disconnect connector and measure at harness side.

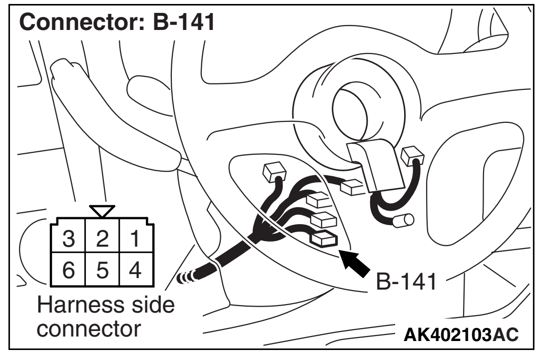
- Ignition switch: ON
- Voltage between terminal No. 1 and earth.

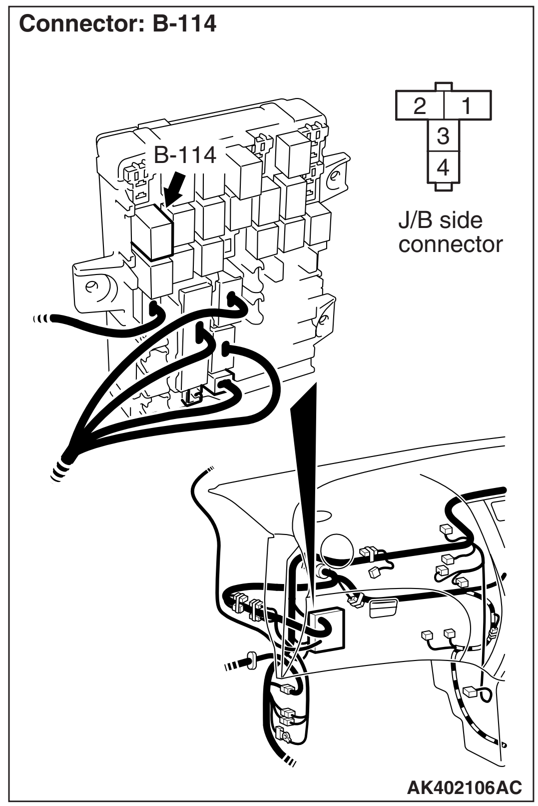
OK: System voltage

Q: Is the check result normal?

YES : Go to Step 8 .
NO : Go to Step 7 .

STEP 7. Connector check: B-141 ignition switch connector





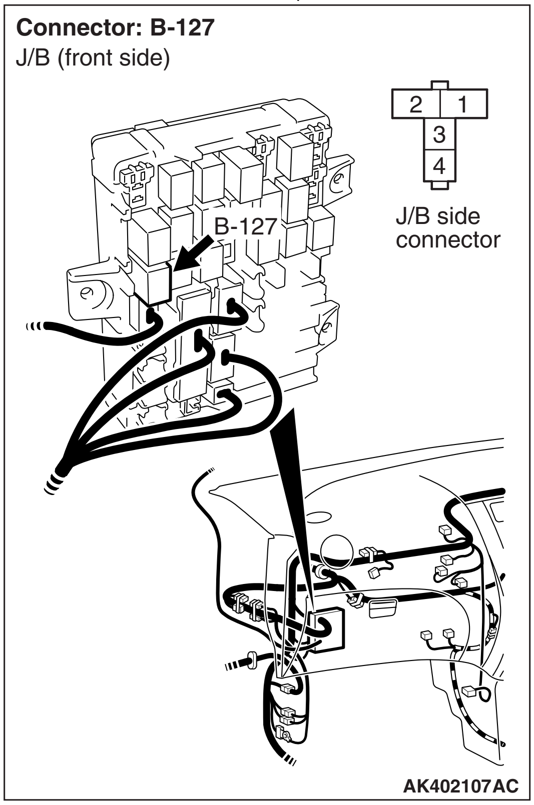
Q: Is the check result normal?

YES : Check intermediate connector B-130, and repair if necessary. If the intermediate connector is normal, check and repair harness between B-141 (terminal No. 4) ignition switch connector and B-114 (terminal No. 1) cooling fan control relay (LO) connector.

- Check power supply line for open/short circuit.

NO : Repair or replace.

STEP 8. Perform voltage measurement at B-127 cooling fan control relay (HI) connector.



Disconnect connector and measure at harness side.

- Voltage between terminal No. 3 and earth.

OK: System voltage

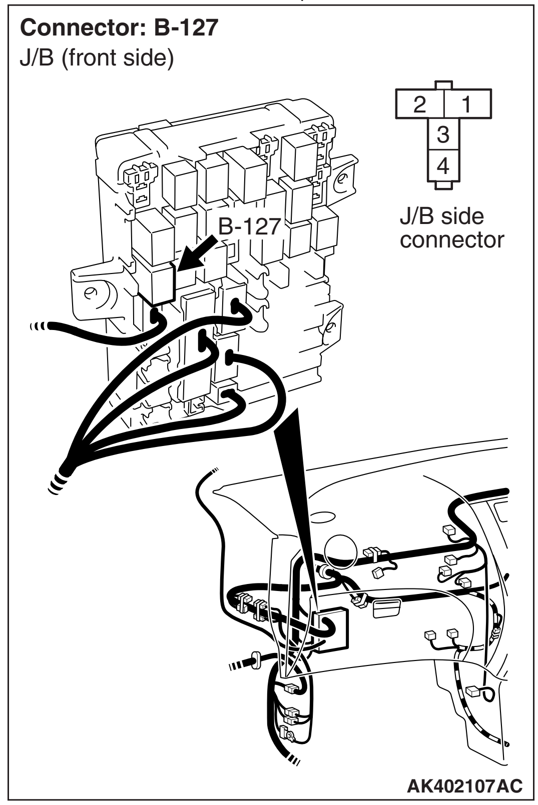
Q: Is the check result normal?

YES : Go to Step 9 .

NO : Check intermediate connector B-108, and repair if necessary. If intermediate connector is normal, check and repair harness between battery and B-127 (terminal No. 3) cooling fan control relay (HI) connector.

- Check power supply line for open/short circuit.

STEP 9. Perform voltage measurement at B-127 cooling fan control relay (HI) connector.



Disconnect connector and measure at harness side.

- Ignition switch: ON
- Voltage between terminal No. 1 and earth.

OK: System voltage

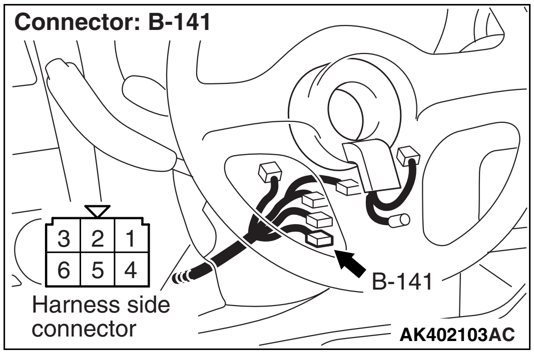
Q: Is the check result normal?

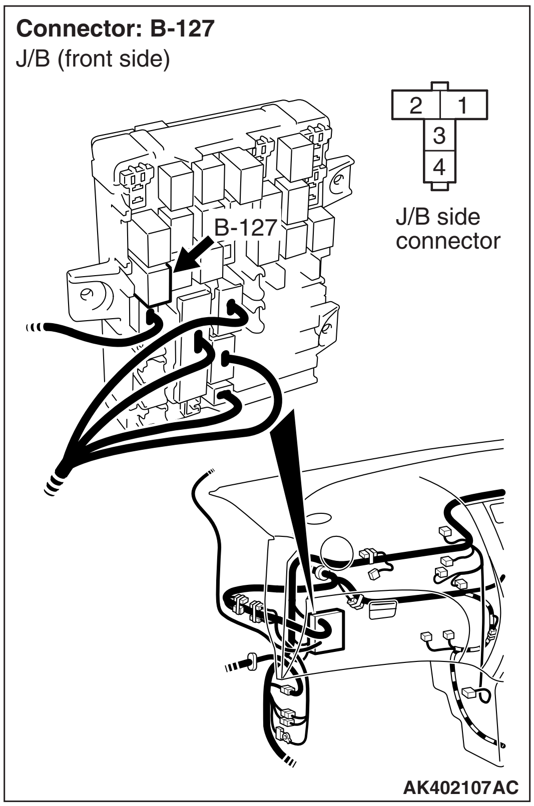
YES : Go to Step 11 .

NO : Go to Step 10 .

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STEP 10. Connector check: B-141 ignition switch connector





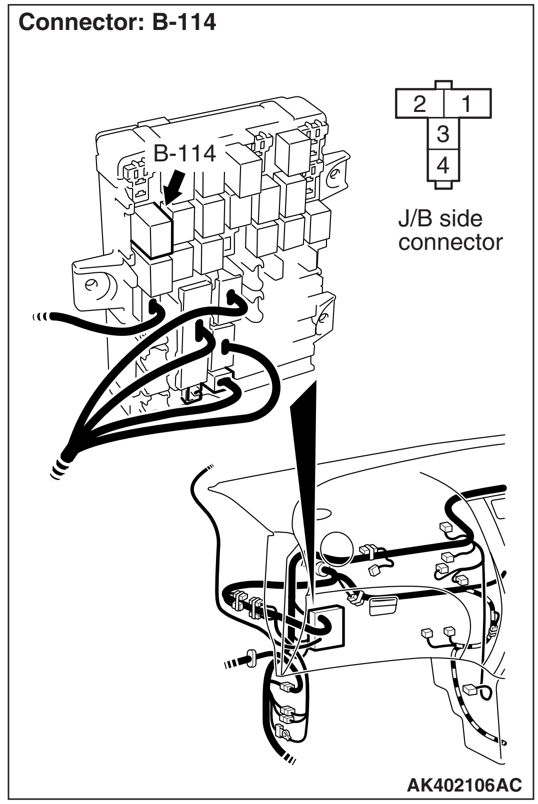
Q: Is the check result normal?

YES : Check intermediate connector B-130, and repair if necessary. If the intermediate connector is normal, check and repair harness between B-141 (terminal No. 4) ignition switch connector and B-127 (terminal No. 1) cooling fan control relay (HI) connector.

- Check power supply line for open/short circuit.

NO : Repair or replace.

STEP 11. Check harness between battery and B-114 (terminal No. 3) cooling fan control relay (LO) connector.



NOTE: Before checking harness, check intermediate connector B-108 and repair if necessary.

- Check power supply line for damage.

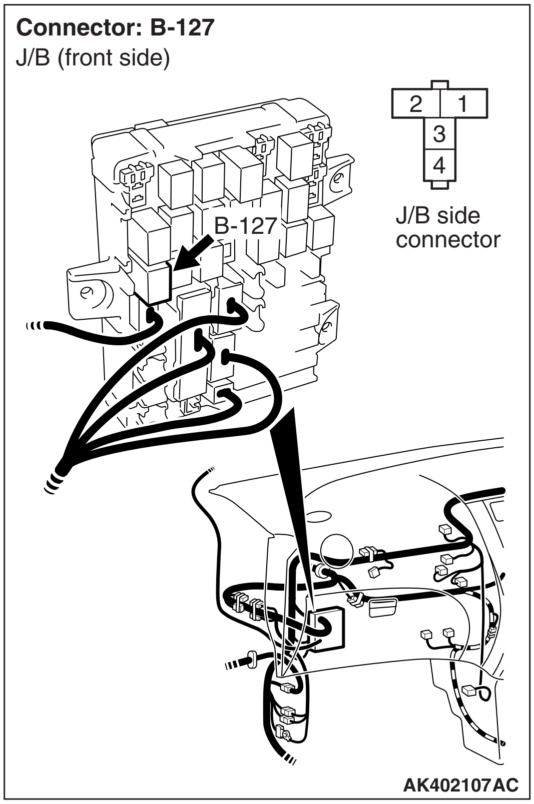
Q: Is the check result normal?

YES : Go to Step 12 .

NO : Repair.

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STEP 12. Check harness between battery and B-127 (terminal No. 3) cooling fan control relay (HI) connector.

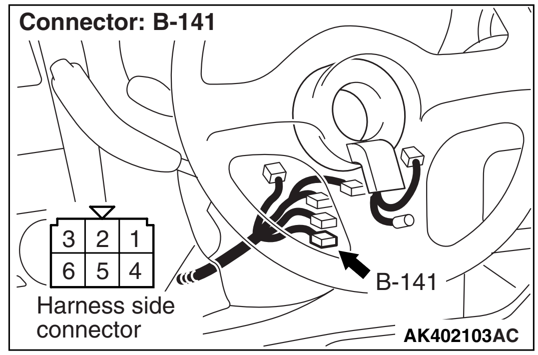


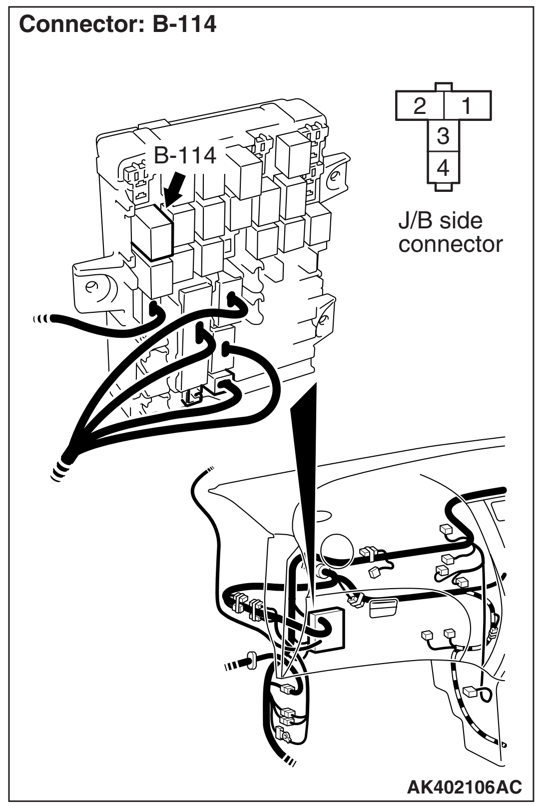
NOTE: Before checking harness, check intermediate connector B-108 and repair if necessary.

- Check power supply line for damage.

Q: Is the check result normal?
YES : Go to Step 13 .
NO : Repair.

STEP 13. Check harness between B-141 (terminal No. 4) ignition switch connector and B-114 (terminal No. 1) cooling fan control relay (LO) connector.





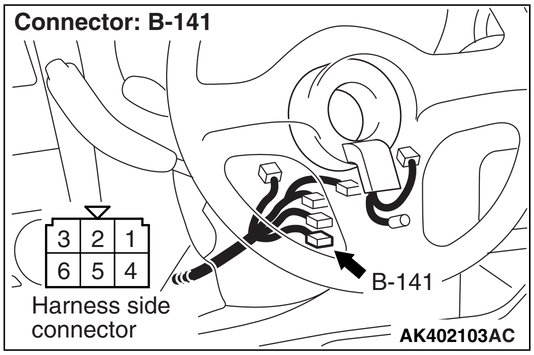
NOTE: Before checking harness, check intermediate connector B-130 and repair if necessary.

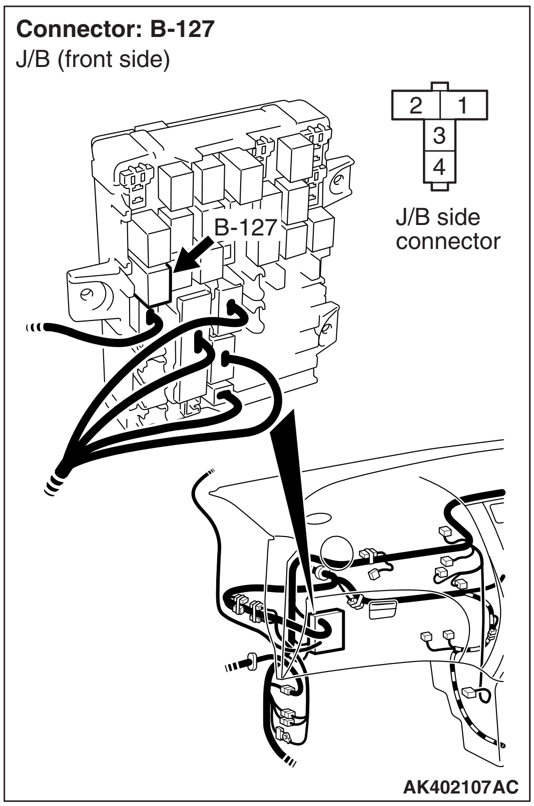
- Check power supply line for damage.

Q: Is the check result normal?
YES : Go to Step 14 .
NO : Repair.

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STEP 14. Check harness between B-141 (terminal No. 4) ignition switch connector and B-127 (terminal No. 1) cooling fan control relay (HI) connector.



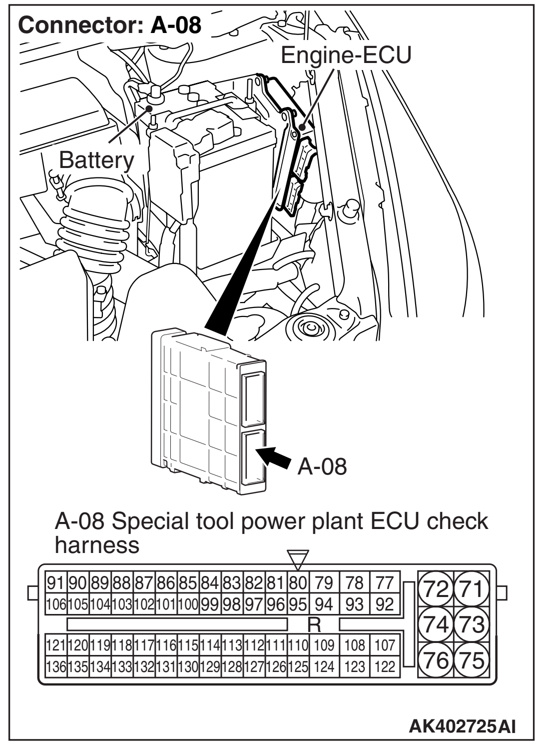


NOTE: Before checking harness, check intermediate connector B-130 and repair if necessary.

- Check power supply line for damage.

Q: Is the check result normal?
YES : Go to Step 15 .
NO : Repair.

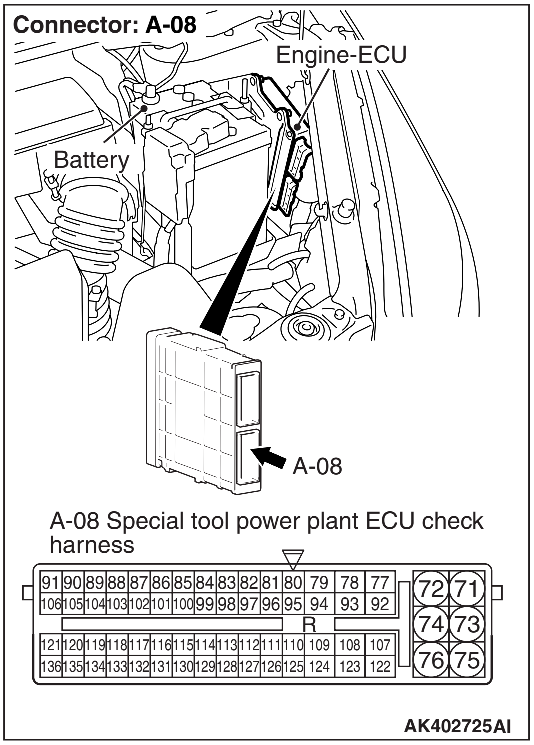
STEP 15. Connector check: A-08 engine-ECU connector

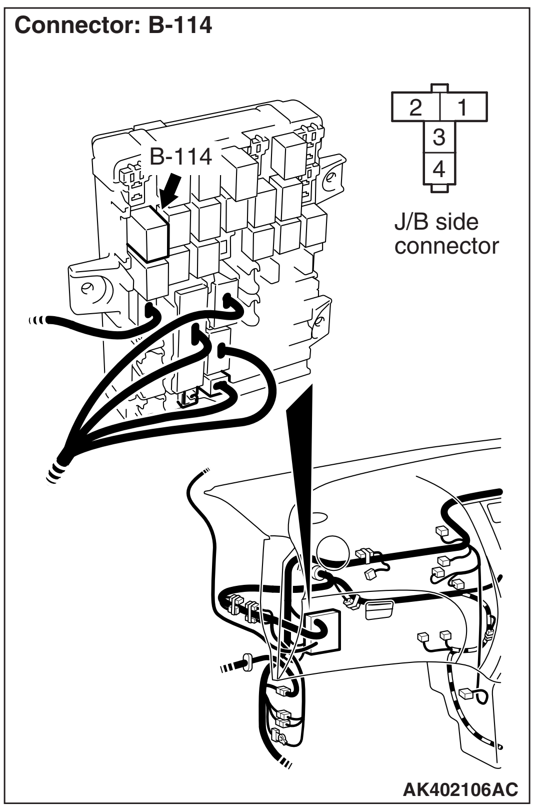


Q: Is the check result normal?
YES : Go to Step 16 .
NO : Repair or replace.

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Group TOC

STEP 16. Perform voltage measurement at A-08 engine-ECU connector.





Disconnect connector and measure at harness side.

- Ignition switch: ON
- Voltage between terminal No. 95 and earth.

OK: System voltage

Q: Is the check result normal?

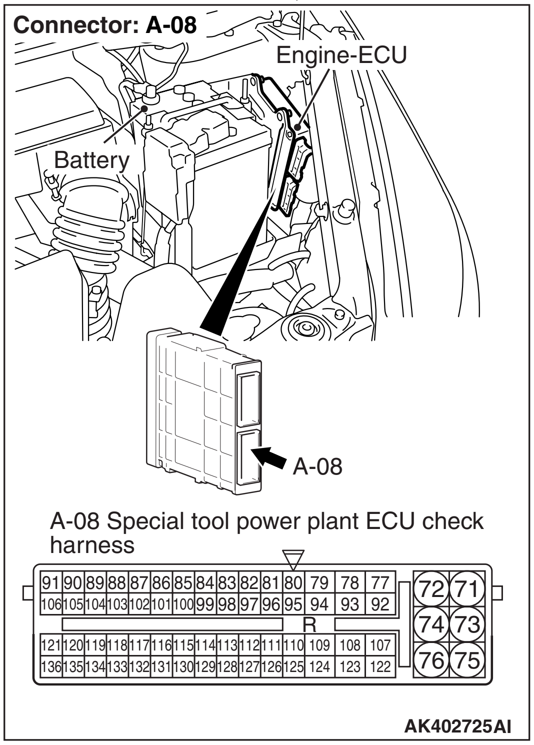
YES : Go to Step 17 .

NO : Check intermediate connector B-110, and repair if necessary. If intermediate connector is normal, check and repair harness between B-114 (terminal No. 2) cooling fan control relay (LO) connector and A-08 (terminal No. 95) engine-ECU connector.

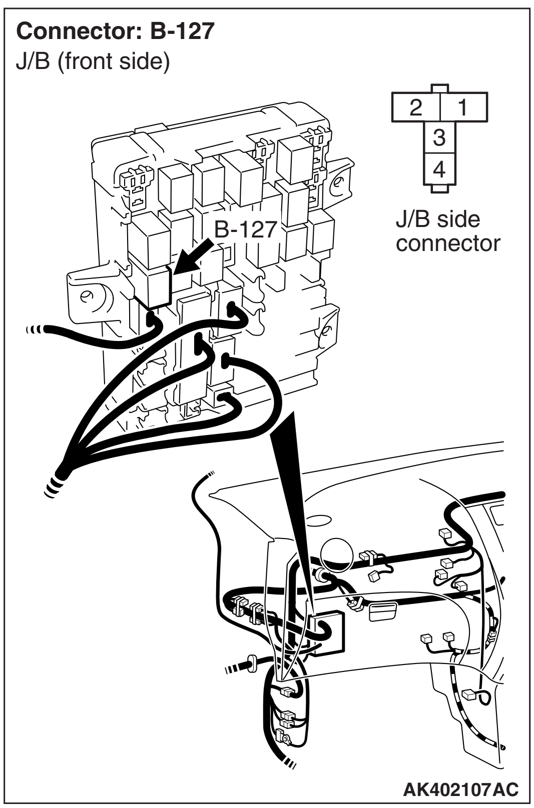
- Check signal line for open/short circuit.

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STEP 17. Perform voltage measurement at A-08 engine-ECU connector.



Connector: A-08



Connector: B-127

Disconnect connector and measure at harness side.

- Ignition switch: ON
- Voltage between terminal No. 96 and earth.

OK: System voltage

Q: Is the check result normal?

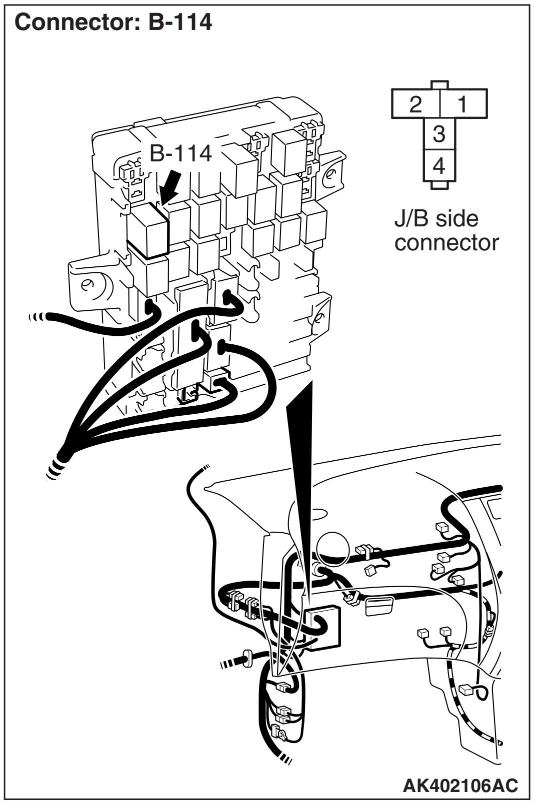
YES : Go to Step 18 .

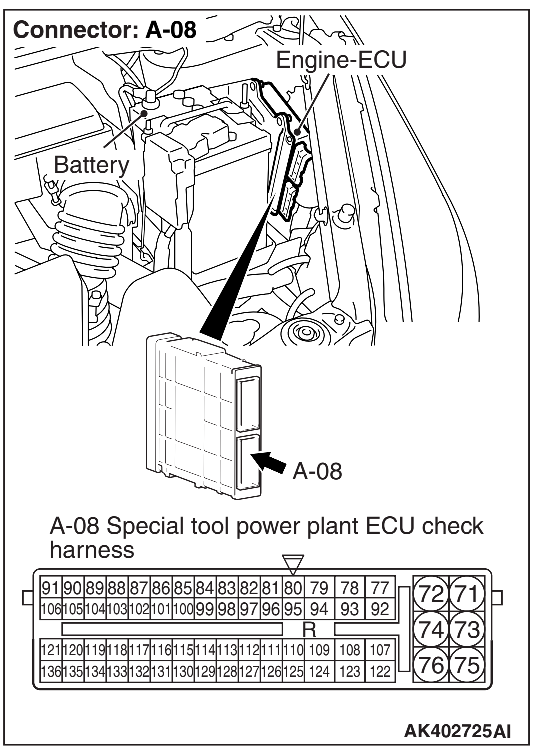
NO : Check intermediate connector B-112, and repair if necessary. If intermediate connector is normal, check and repair harness between B-127 (terminal No. 2) cooling fan control relay (HI) connector and A-08 (terminal No. 96) engine-ECU connector.

- Check signal line for open/short circuit.

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STEP 18. Check harness between B-114 (terminal No. 2) cooling fan control relay (LO) connector and A-08 (terminal No. 95) engine-ECU connector.





NOTE: Before checking harness, check intermediate connector B-110 and repair if necessary.

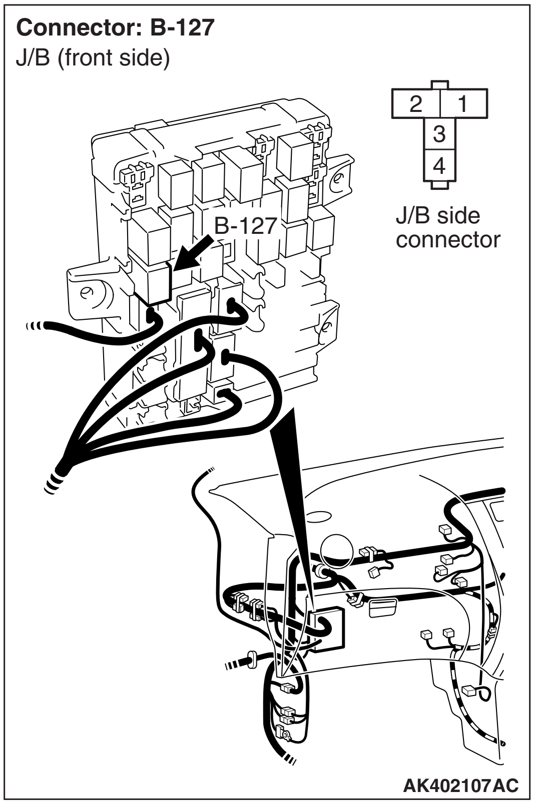
- Check signal line for damage.

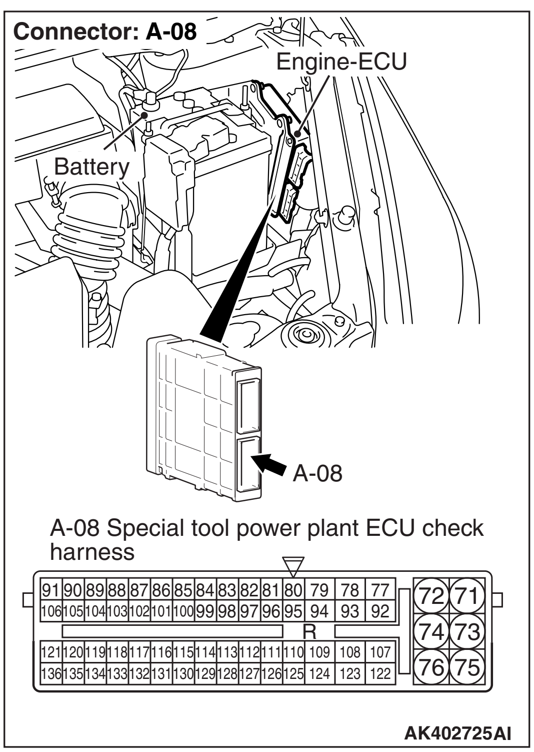
Q: Is the check result normal?

YES : Go to Step 19 .

NO : Repair.

STEP 19. Check harness between B-127 (terminal No. 2) cooling fan control relay (HI) connector and A-08 (terminal No. 96) engine-ECU connector.





NOTE: Before checking harness, check intermediate connector B-112 and repair if necessary.

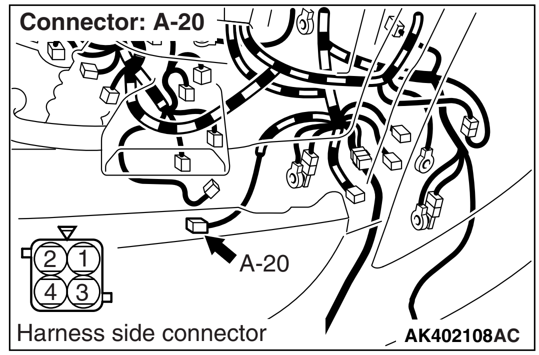
- Check signal line for damage.

Q: Is the check result normal?

YES : Go to Step 20 .

NO : Repair.

STEP 20. Perform resistance measurement at A-20 cooling fan motor connector.



Disconnect connector and measure at harness side.

- Resistance between terminal No. 2, No. 4 and earth.

OK: Continuity (2 Ω or less)

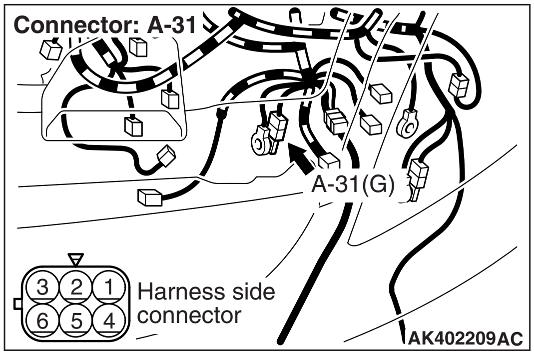
Q: Is the check result normal?

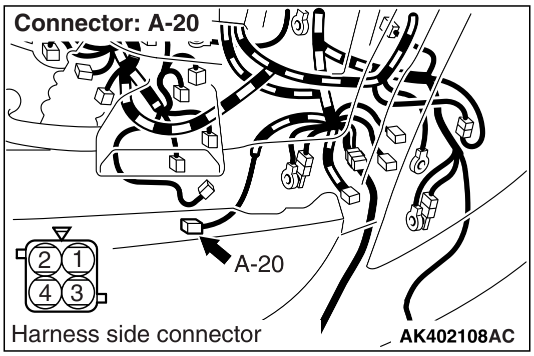
YES : Go to Step 22 .

NO : Go to Step 21 .

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STEP 21. Connector check: A-31 joint connector





Q: Is the check result normal?

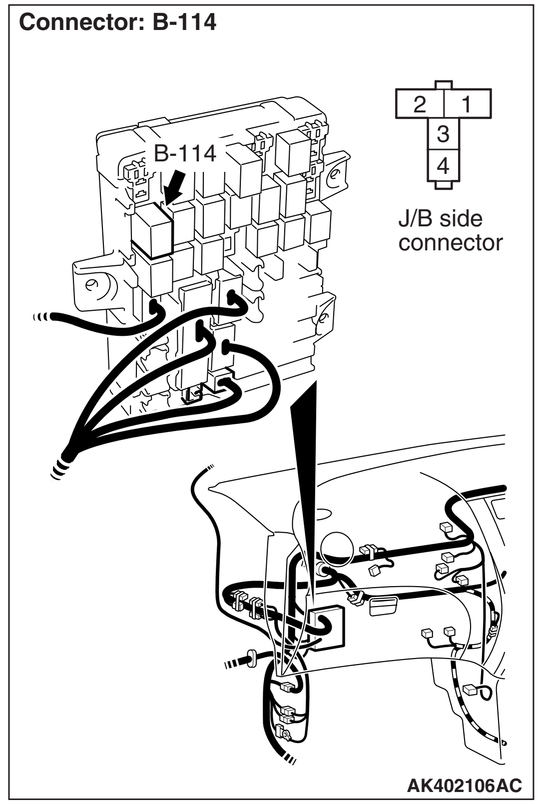
YES : a. Check and repair harness between A-20 (terminal No. 2) cooling fan motor connector and A-31 (terminal No. 2) joint connector.

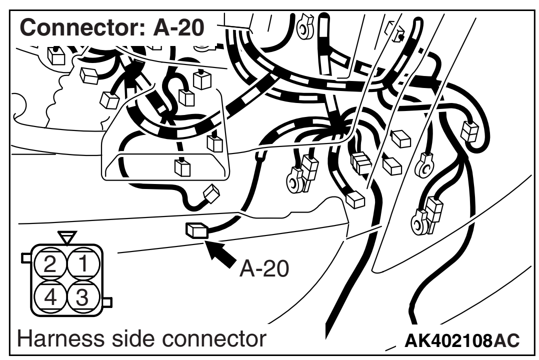
b. Check and repair harness between A-20 (terminal No. 4) cooling fan motor connector and A-31 (terminal No. 5) joint connector.

- Check earthing line for damage.

NO : Repair or replace.

STEP 22. Check harness between B-114 (terminal No. 4) cooling fan control relay (LO) connector and A-20 (terminal No. 1) cooling fan motor connector.





NOTE: Before checking harness, check intermediate connector B-109 and repair if necessary.

- Check power supply line for open/short circuit or damage.

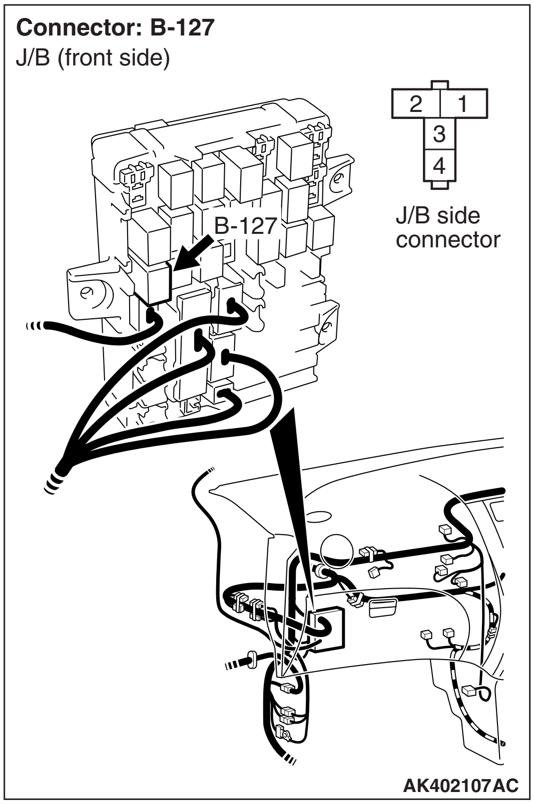
Q: Is the check result normal?

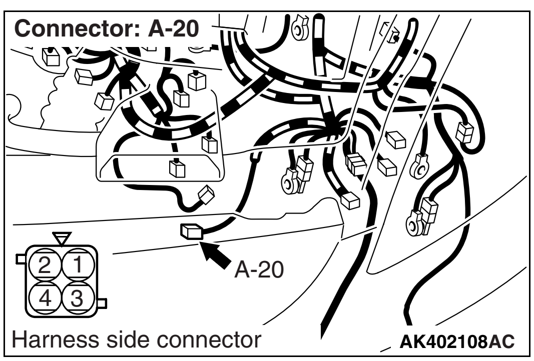
YES : Go to Step 23 .

NO : Repair.

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Group TOC

STEP 23. Check harness between B-127 (terminal No. 4) cooling fan control relay (HI) connector and A-20 (terminal No. 3) cooling fan motor connector.





NOTE: Before checking harness, check intermediate connector B-109 and repair if necessary.

- Check power supply line for open/short circuit or damage.

Q: Is the check result normal?

YES : Go to Step 24 .
NO : Repair.

STEP 24. M.U.T.-III actuator test

- Refer to Actuator Test Reference Table P.13B-344.
  a. Item 20: Cooling fan motor (HI)
  b. Item 21: Cooling fan motor (LO)

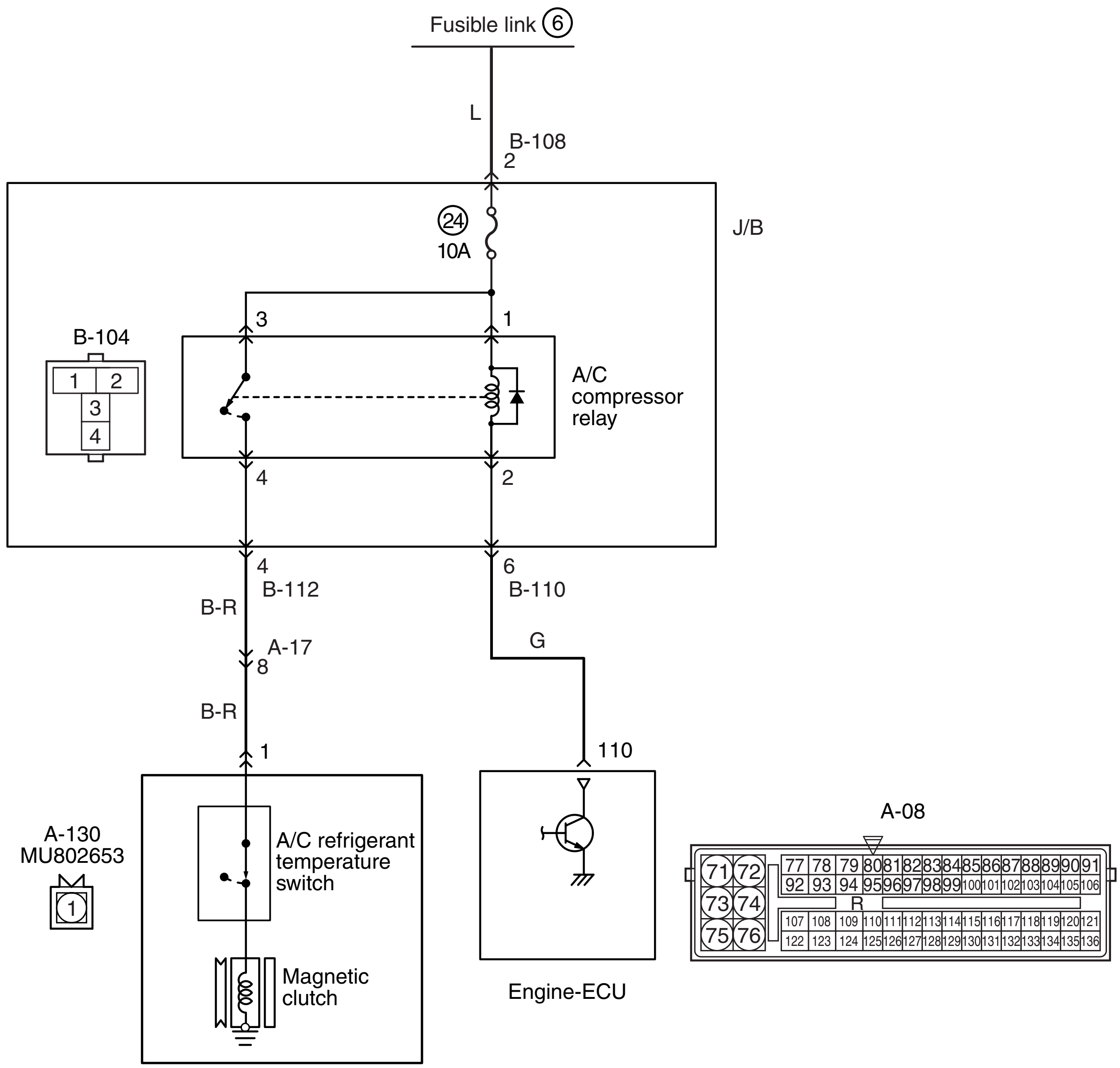
Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).
NO : Replace engine-ECU.

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Group TOC

Inspection Procedure 24: A/C Compressor Relay System

A/C Compressor Relay Circuit



Wire colour code
B: Black LG: Light green G: Green L: Blue W: White Y: Yellow SB: Sky blue BR: Brown O: Orange GR: Gray
R: Red P: Pink V: Violet P: Purple

AK402705AF

OPERATION

- The battery voltage is applied to the A/C compressor relay (terminal No. 1 and No. 3).
- The engine-ECU (terminal No. 110) makes the power transistor in the unit be in ON position and makes currents go on the A/C compressor relay coil, and that makes the relay be in ON position.
- When the A/C compressor relay is switched ON, the battery voltage is supplied from the A/C compressor relay (terminal No. 4) to the A/C compressor (terminal No. 1).

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FUNCTION

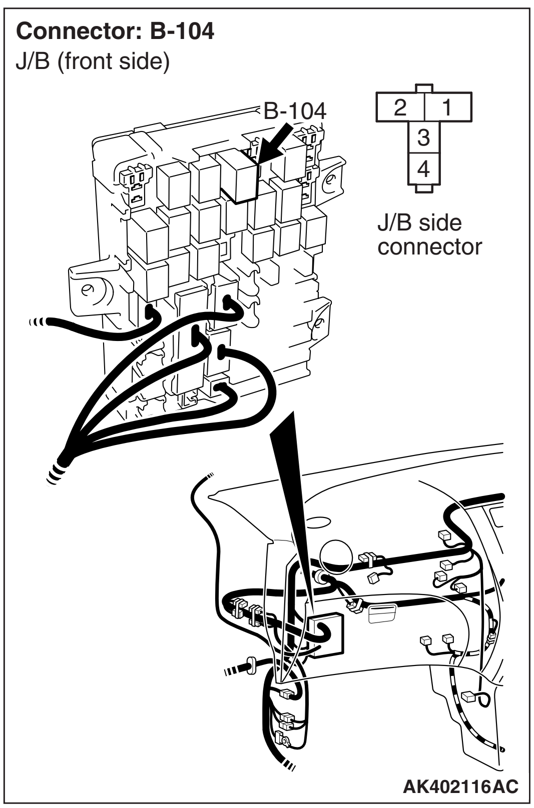
- When the A/C switch ON signal is input to the engine-ECU, the engine-ECU places the A/C compressor relay in the ON position. Accordingly, the battery voltage supplied to the A/C compressor operates the magnet clutch.

PROBABLE CAUSES

- Failed A/C compressor relay
- Failed A/C compressor
- Open/short circuit in or damage to the A/C compressor relay circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Connector check: B-104 A/C compressor relay connector



Q: Is the check result normal?

YES : Go to Step 2 .

NO : Repair or replace.

STEP 2. Check A/C compressor relay.

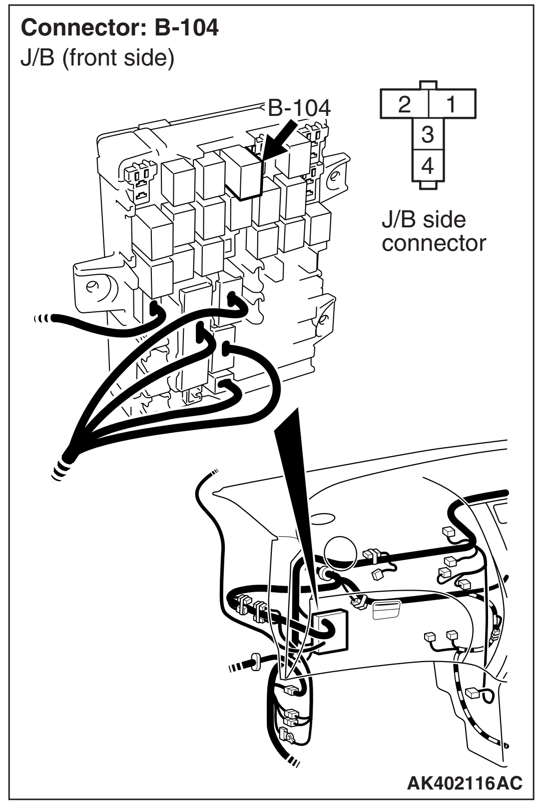
- Check A/C compressor relay (Refer to GROUP 55A – On-vehicle Service – Power Relay Check P.55A-52).

Q: Is the check result normal?

YES : Go to Step 3 .

NO : Replace A/C compressor relay.

STEP 3. Perform voltage measurement at B-104 A/C compressor relay.



Disconnect connector and measure at harness side.

- Voltage between terminal No. 1, No. 3 and earth.

OK: System voltage

Q: Is the check result normal?

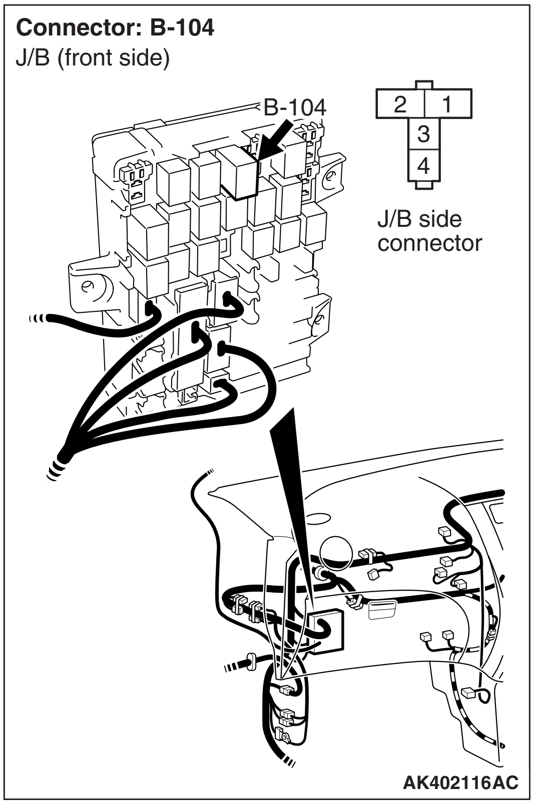
YES : Go to Step 4 .

NO : Check intermediate connector B-108, and repair if necessary. If intermediate connector is normal, check and repair harness between battery and B-104 (terminal No. 1 and No. 3) A/C compressor relay connector.

- Check power supply line for open/short circuit.

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STEP 4. Check harness between battery and B-104 (terminal No. 1 and No. 3) A/C compressor relay connector.



NOTE: Before checking harness, check intermediate connector B-108 and repair if necessary.

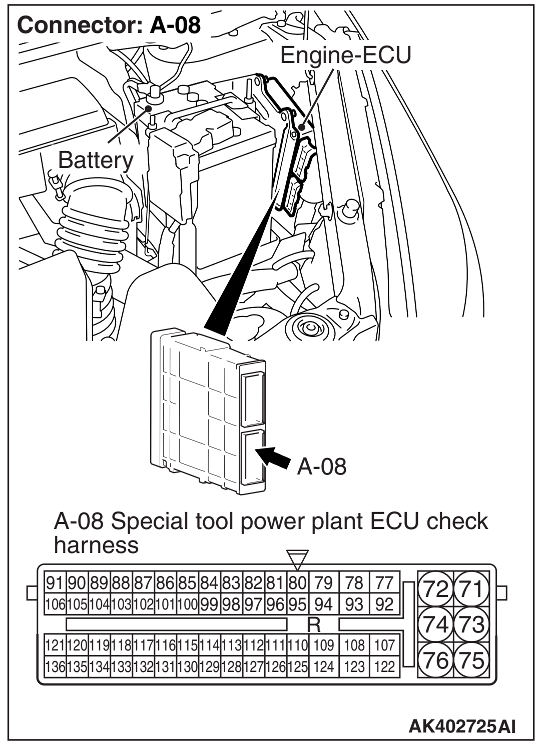
- Check power supply line for damage.

Q: Is the check result normal?

YES : Go to Step 5 .

NO : Repair.

STEP 5. Connector check: A-08 engine-ECU connector



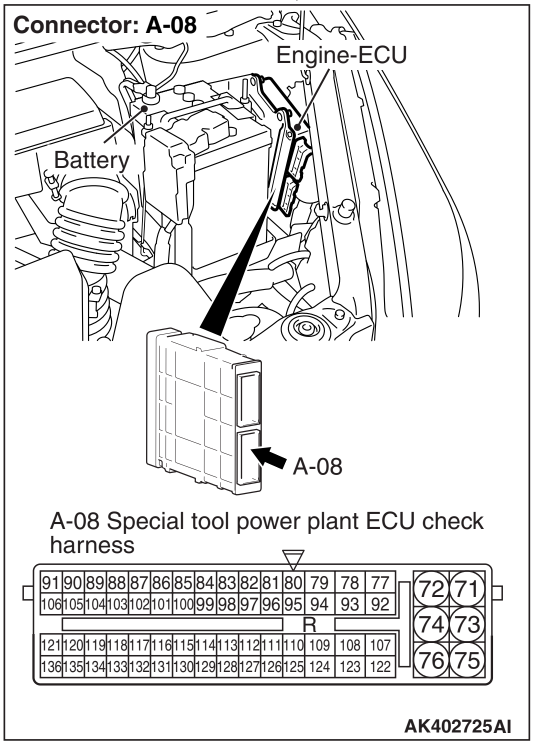
Q: Is the check result normal?

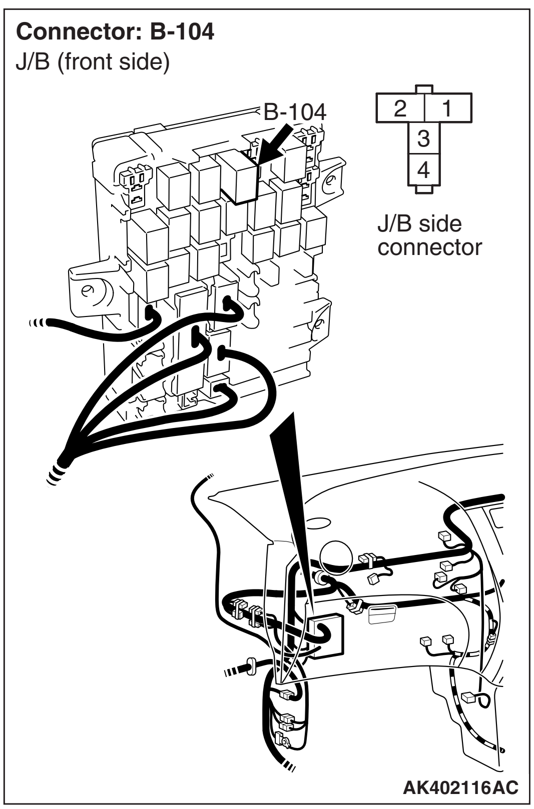
YES : Go to Step 6 .

NO : Repair or replace.

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Group TOC

STEP 6. Perform voltage measurement at A-08 engine-ECU connector.





Disconnect connector and measure at harness side.

- Voltage between terminal No. 110 and earth.

OK: System voltage

Q: Is the check result normal?

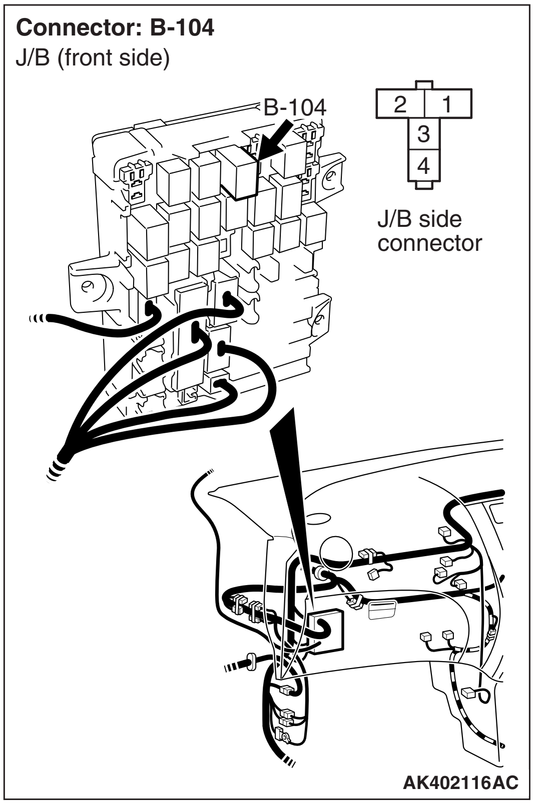
YES : Go to Step 7 .

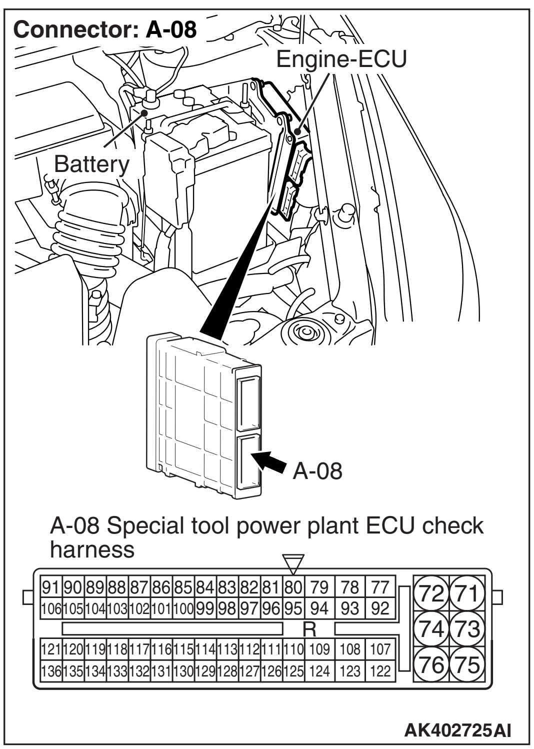
NO : Check intermediate connector B-110, and repair if necessary. If intermediate connector is normal, check and repair harness between B-104 (terminal No. 2) A/C compressor relay connector and A-08 (terminal No. 110) engine-ECU connector.

- Check signal line for open/short circuit.

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STEP 7. Check harness between B-104 (terminal No. 2) A/C compressor relay connector and A-08 (terminal No. 110) engine-ECU connector.





NOTE: Before checking harness, check intermediate connector B-110 and repair if necessary.

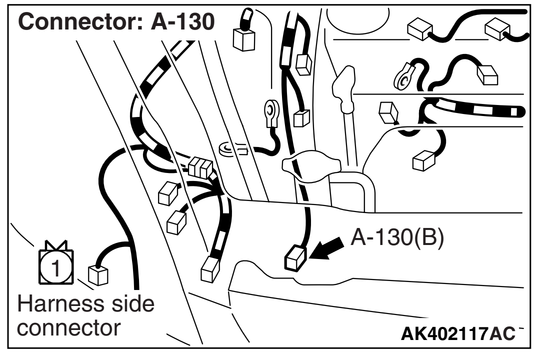
- Check signal line for damage.

Q: Is the check result normal?

YES : Go to Step 8 .

NO : Repair.

STEP 8. Connector check: A-130 A/C compressor connector



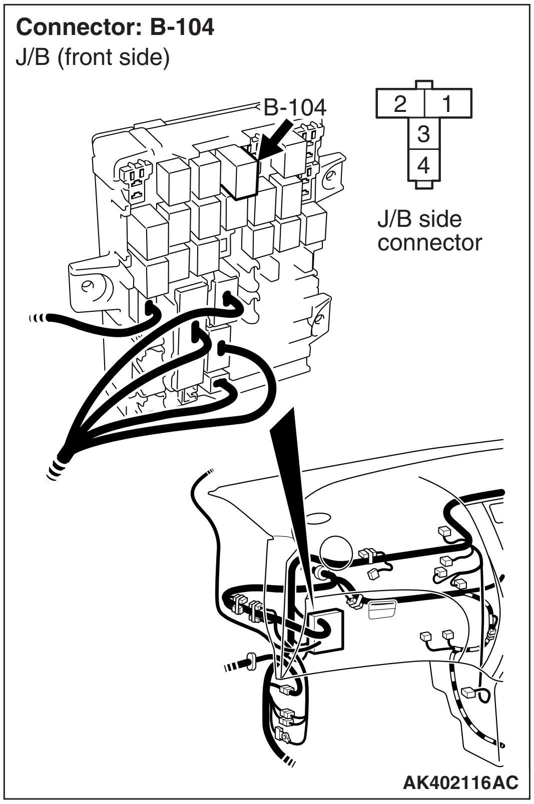
Q: Is the check result normal?

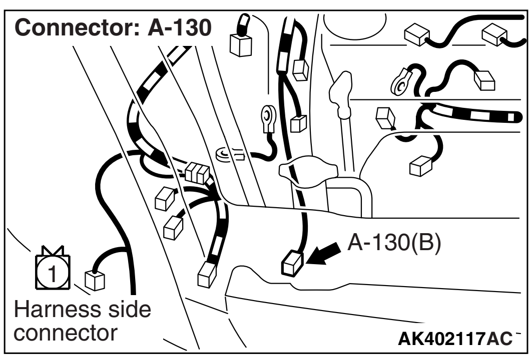
YES : Go to Step 9 .

NO : Repair or replace.

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STEP 9. Check harness between B-104 (terminal No. 4) A/C compressor relay connector and A-130 (terminal No. 1) A/C compressor connector.





NOTE: Before checking harness, check intermediate connector B-112, A-17, and repair if necessary.

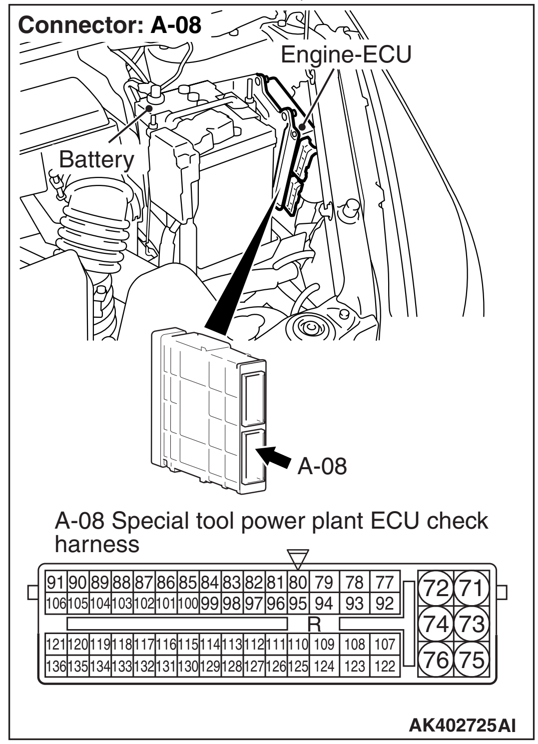
- Check power supply line for open/short circuit or damage.

Q: Is the check result normal?

YES : Go to Step 10 .

NO : Repair.

STEP 10. Confirm that A/C compressor is driven



Disconnect A-08 engine-ECU connector, and terminal No. 110 is earth short-circuited.

OK: A/C compressor is driven

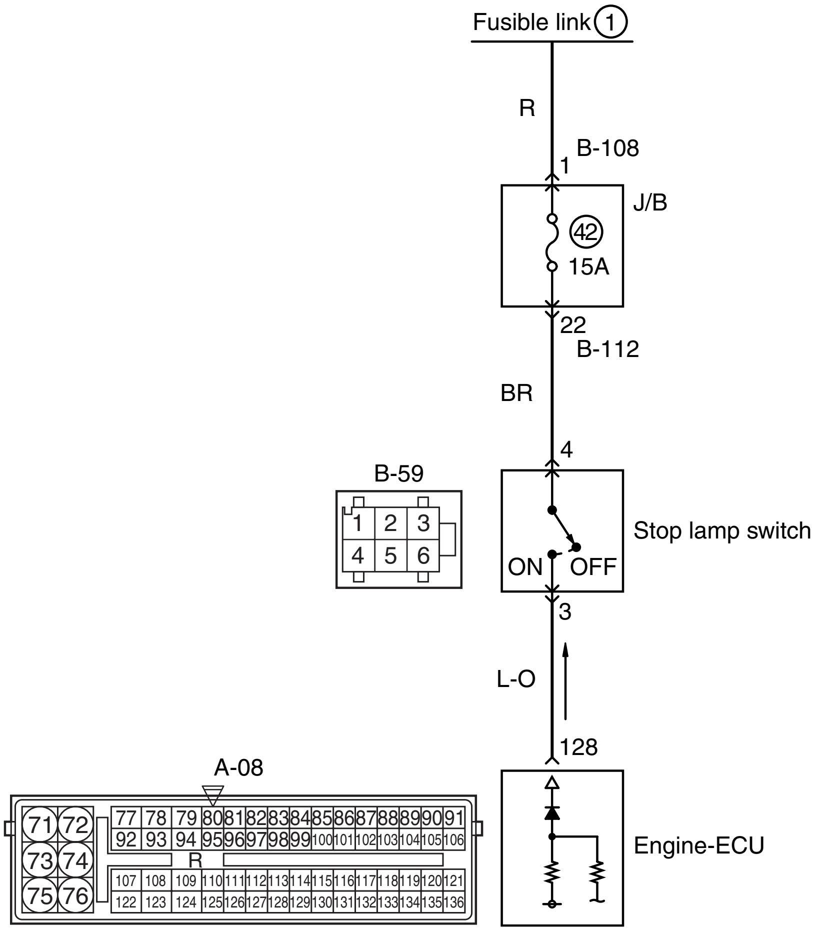
Q: Is the check result normal?

YES : Replace engine-ECU.

NO : Replace A/C compressor.

Inspection Procedure 25: Stop Lamp Switch System

Stop Lamp Switch Circuit



Wire colour code
B: Black LG: Light green G: Green L: Blue W: White Y: Yellow SB: Sky blue BR: Brown O: Orange GR: Gray
R: Red P: Pink V: Violet P: Purple

AK600592AB

OPERATION

- The battery voltage is applied to the stop lamp switch (terminal No. 2).
- The stop lamp switch output terminal (terminal No. 1) inputs the switch signal to the engine-ECU (terminal No. 128).

FUNCTION

- The system checks whether the vehicle has the illuminating stop lamp or not, and inputs the signal to the engine-ECU. The engine-ECU knows the vehicle state through the stop lamp switch signal and carries out control of each system.

PROBABLE CAUSES

- Failed stop lamp switch
- Open/short circuit in stop lamp switch circuit or loose connector contact
- Failed engine-ECU

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DIAGNOSIS PROCEDURE

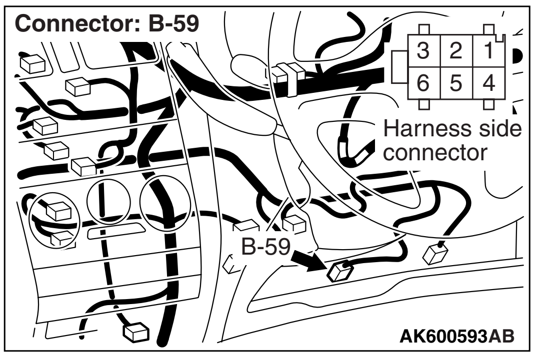
STEP 1. Check for height of brake pedal.

- Check for height of brake pedal (Refer to GROUP 35A – On-vehicle Service – Brake Pedal Check And Adjustment P.35A-7).

Q: Is the check result normal?

YES : Go to Step 2 .
NO : Adjust.

STEP 2. Connector check: B-59 stop lamp switch connector



Q: Is the check result normal?

YES : Go to Step 3 .
NO : Repair or replace.

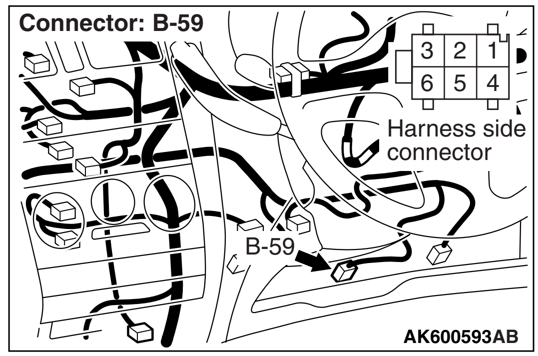
STEP 3. Check stop lamp switch.

- Check stop lamp switch (Refer to GROUP 35A – On-vehicle Service – Brake Pedal Check And Adjustment P.35A-22).

Q: Is the check result normal?

YES : Go to Step 4 .
NO : Replace stop lamp switch.

STEP 4. Perform voltage measurement at B-59 stop lamp switch connector.



- Disconnect connector and measure at harness side.
- Voltage between terminal No. 4 and earth.

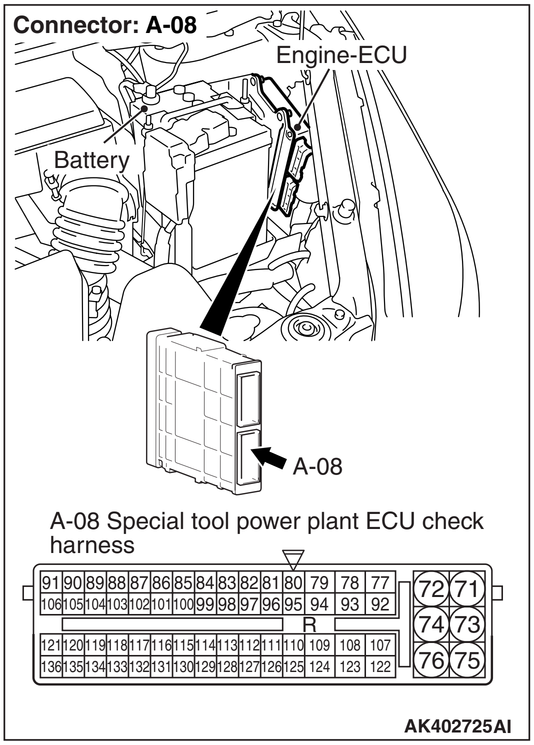
OK: System voltage

Q: Is the check result normal?

YES : Go to Step 5 .
NO : Check intermediate connector B-112, B-108, and repair if necessary. If intermediate connectors are normal, check and repair harness between B-59 (terminal No. 4) stop lamp switch connector and battery.
- Check power supply line for open/short circuit.

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STEP 5. Connector check: A-08 engine-ECU connector

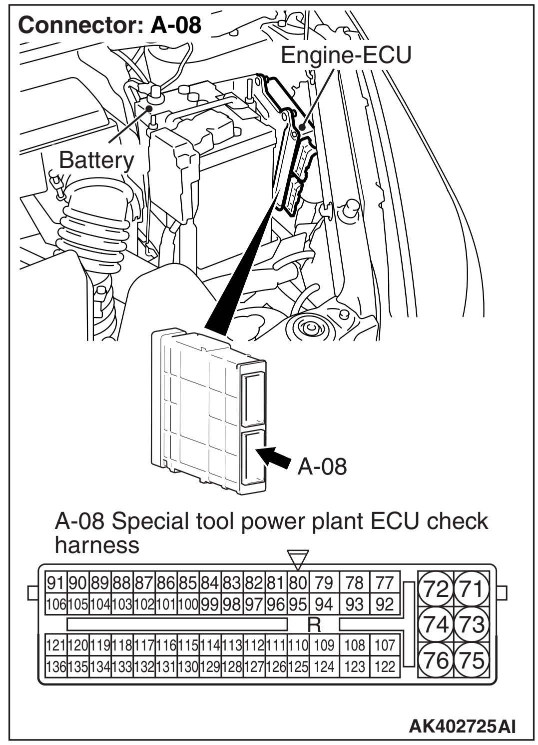


Q: Is the check result normal?

YES : Go to Step 6 .

NO : Repair or replace.

STEP 6. Perform voltage measurement at A-08 engine-ECU connector.



- Disconnect engine-ECU connector, and connect Special Tool Power Plant ECU Check Harness (MB991987), and measure the voltage on the check connector.
- Voltage between terminal No. 128 and earth.

OK:

System voltage (Brake pedal: Depressed)

1 V or less (Brake pedal: Released)

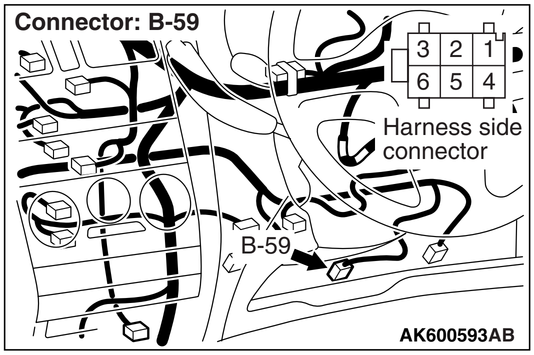
Q: Is the check result normal?

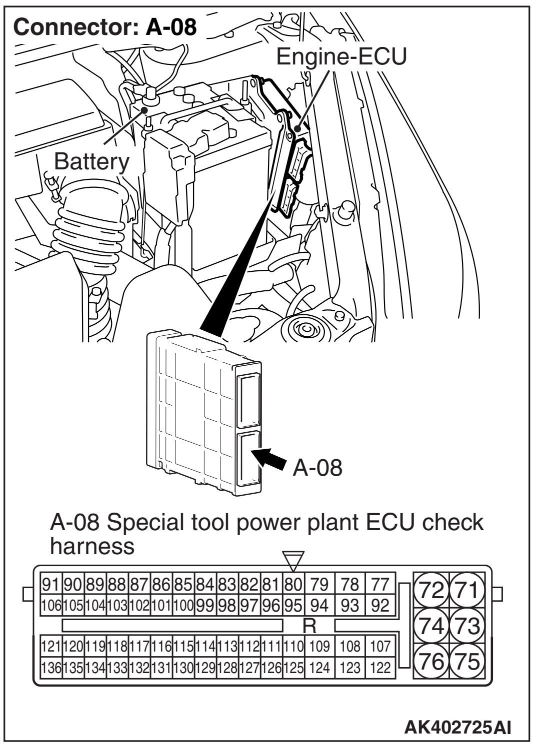
YES : Go to Step 8 .

NO : Go to Step 7 .

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STEP 7. Check harness between B-59 (terminal No. 3) stop lamp switch connector and A-08 (terminal No. 128) engine-ECU.





- Check output line for open/short circuit.

Q: Is the check result normal?

YES : Check and repair the stop lamp switch output signal harness and connector for short circuit.

NO : Repair.

STEP 8. M.U.T.-III data list

- Refer to Data List Reference Table P.13B-335.
  a. Item 67: Stop lamp switch

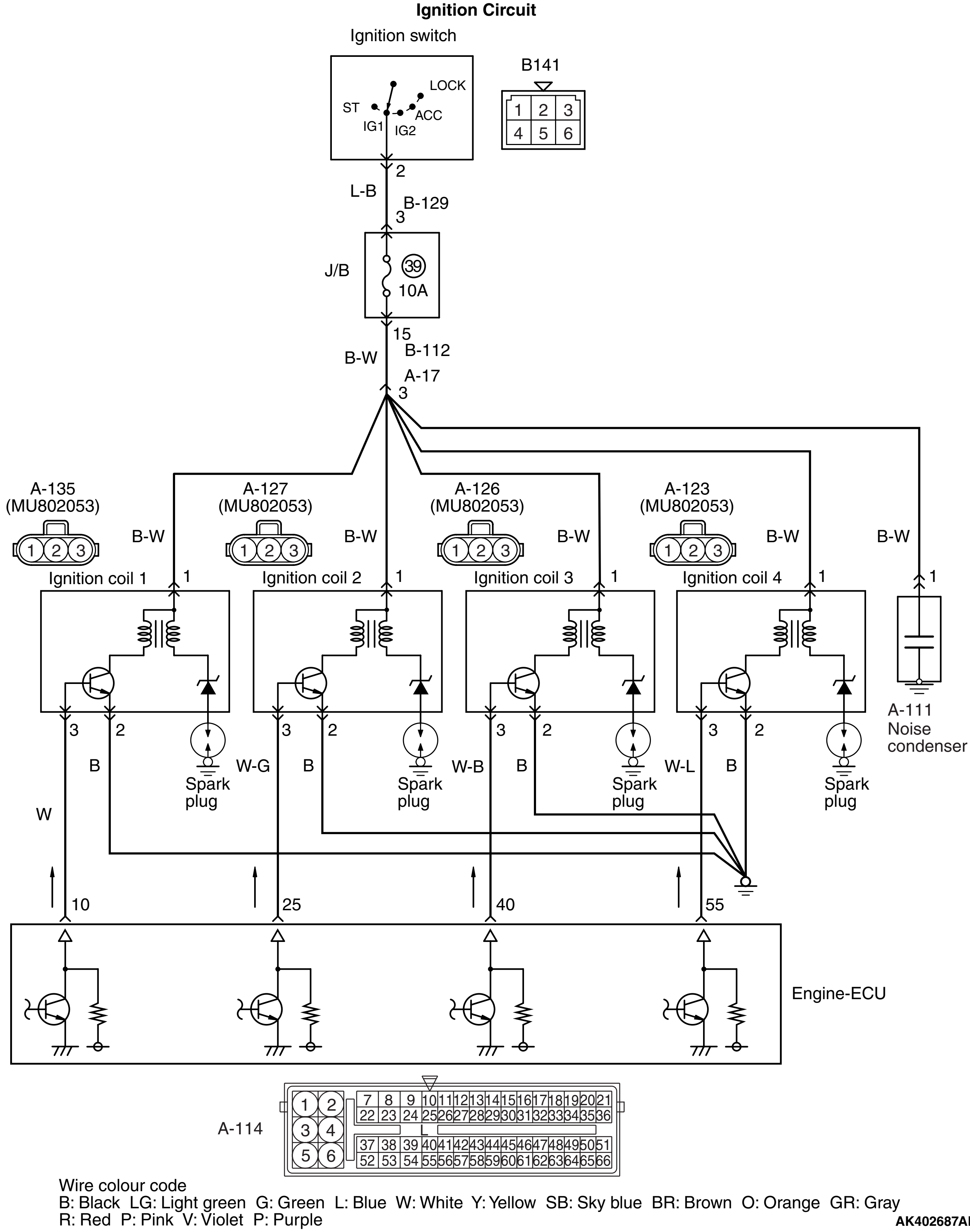
Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

NO : Replace engine-ECU.

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Inspection Procedure 26: Ignition Circuit System



Wire colour code
B: Black LG: Light green G: Green L: Blue W: White Y: Yellow SB: Sky blue BR: Brown O: Orange GR: Gray
R: Red P: Pink V: Violet P: Purple

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OPERATION

- The battery voltage is applied to the ignition coil (terminal No. 1) from the ignition switch and is earthed to the vehicle body from the ignition coil (terminal No. 2).
- A power voltage of 12 V is applied to the ignition coil (terminal No. 3) from the engine-ECU (terminals No. 10, No. 25, No. 40 and No. 55).

FUNCTION

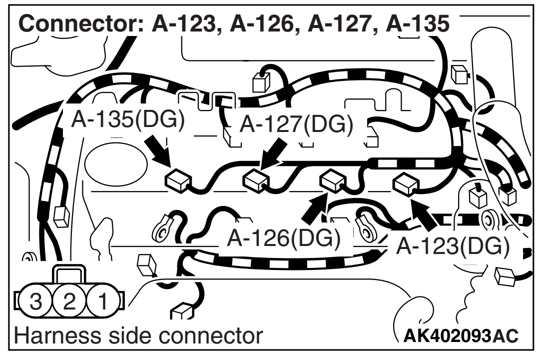
- When the engine-ECU makes the power transistor in the unit be in OFF position, the battery voltage is applied to the power transistor in the ignition coil, making the power transistor be in ON position. The engine-ECU makes the power transistor in the unit be in ON position, and that makes the power transistor in the ignition coil be in OFF position.
- When the power transistor in the ignition coil is turned to ON position in response to the signal from the engine-ECU, the primary current flows through the ignition coil. When the power transistor in the ignition coil is turned to OFF position, the primary current is interrupted and high voltage is generated in the secondary coil.

PROBABLE CAUSES

- Failed spark plug
- Failed ignition coil
- Open/short circuit in or damage to the ignition circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Connector check: A-123, A-126, A-127 and A-135 ignition coil connector



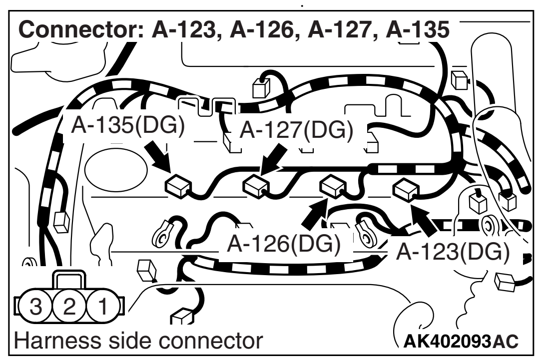
Q: Is the check result normal?
YES : Go to Step 2 .
NO : Repair or replace.

STEP 2. Check ignition coil.

- Check ignition coil (Refer to GROUP 16 – Ignition System – On-vehicle Service – Ignition Coil Check P.16-34).

Q: Is the check result normal?
YES : Go to Step 3 .
NO : Replace ignition coil.

STEP 3. Perform voltage measurement at A-123, A-126, A-127 and A-135 ignition coil connectors.



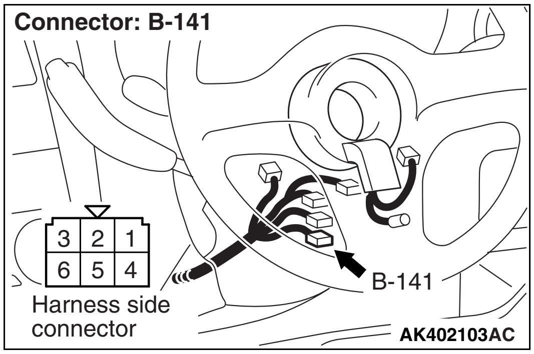
Disconnect connector and measure at harness side.
- Ignition switch: ON
- Voltage between terminal No. 1 and earth.

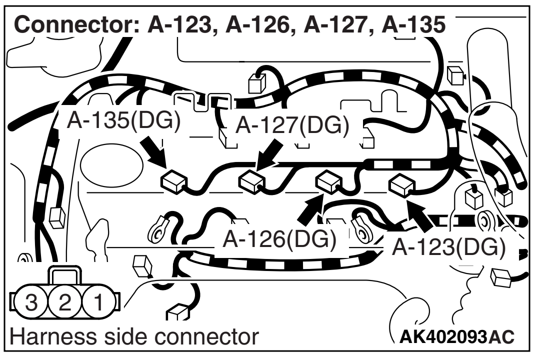
OK: System voltage

Q: Is the check result normal?
YES : Go to Step 5 .
NO : Go to Step 4 .

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STEP 4. Connector check: B-141 ignition switch connector





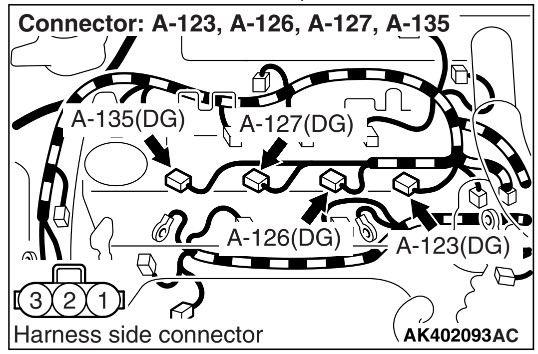
Q: Is the check result normal?

YES : Check intermediate connectors A-17, B-112 and B-129, and repair if necessary. If intermediate connectors are normal, check and repair harness between B-141 (terminal No. 2) ignition switch connector and A-123, A-126, A-127 and A-135 (terminal No. 1) ignition coil connectors.

- Check power supply line for open/short circuit.

NO : Repair or replace.

STEP 5. Perform resistance measurement at A-123, A-126, A-127 and A-135 ignition coil connectors.



Disconnect connector and measure at harness side.

- Resistance between terminal No. 2 and earth.

OK: Continuity (2 Ω or less)

Q: Is the check result normal?

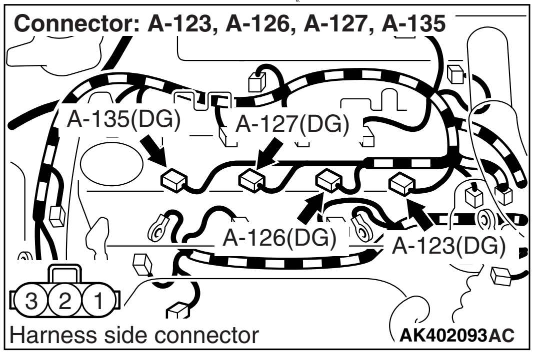
YES : Go to Step 6 .

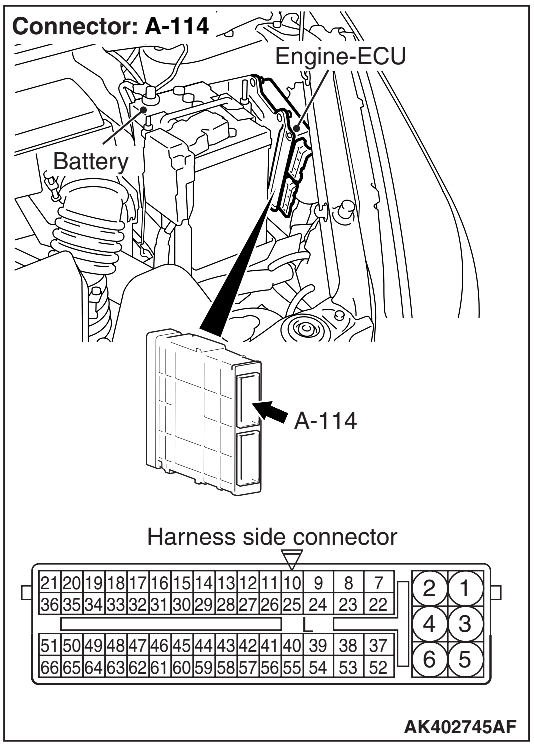
NO : Check and repair harness between A-123, A-126, A-127 and A-135 (terminal No. 2) ignition coil connectors and body earth.

- Check earthing line for open circuit and damage.

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STEP 6. Check harness between ignition coil connector and engine-ECU connector.





Check and repair harness between A-135 (terminal No. 3) No. 1 ignition coil connector and A-114 (terminal No. 10) engine-ECU connector.

b. Check and repair harness between A-127 (terminal No. 3) No. 2 ignition coil connector and A-114 (terminal No. 25) engine-ECU connector.

c. Check and repair harness between A-126 (terminal No. 3) No. 3 ignition coil connector and A-114 (terminal No. 40) engine-ECU connector.

d. Check and repair harness between A-123 (terminal No. 3) No. 4 ignition coil connector and A-114 (terminal No. 55) engine-ECU connector.

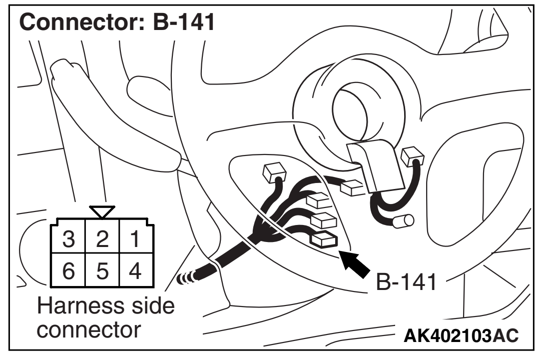
- Check signal line for open/short circuit and damage.

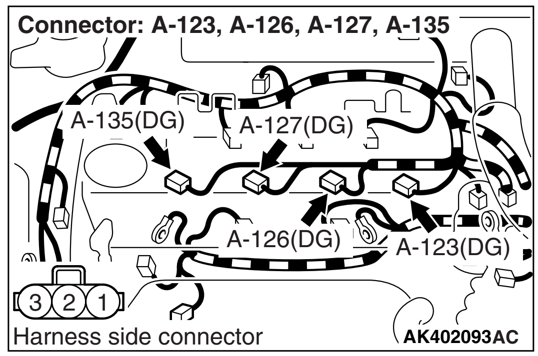
Q: Is the check result normal?

YES : Go to Step 7 .

NO : Repair.

STEP 7. Check harness between B-141 (terminal No. 2) ignition switch connector and A-123, A-126, A-127 and A-135 (terminal No. 1) ignition coil connector.





NOTE: Before checking harness, check intermediate connectors A-17, B-112 and B-129, and repair if necessary.

- Check power supply line for damage.

Q: Is the check result normal?

YES : Go to Step 8 .

NO : Repair.

STEP 8. Visual check of ignition spark.

- Remove the spark plug and install it to the ignition coil.
- Connect the ignition coil connector.
- Remove all injector connector.
- At the engine start, check each spark plug produces a spark.

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13).

NO : Go to Step 9 .

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STEP 9. Check spark plug.

- Check spark plug (Refer to GROUP 16 – Ignition System – On-vehicle Service P.16-35).

Q: Is the check result normal?
YES : Go to Step 10 .
NO : Replace the spark plug.

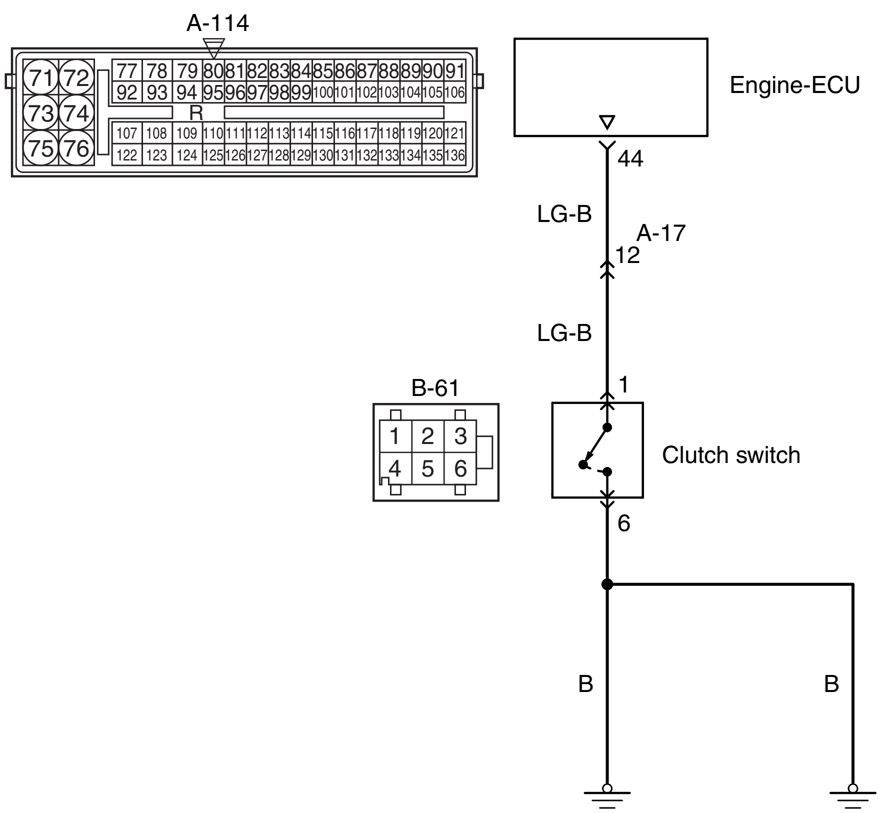
STEP 10. Replace ignition coil.

- After a good ignition coil is temporarily installed, do a test for spark at the ignition coil again.

Q: Is the check result normal?
YES : Replace ignition coil.
NO : Replace engine-ECU.

Inspection Procedure 27: Clutch Switch System

Clutch Switch Circuit



Wire colour code
B: Black LG: Light green G: Green L: Blue W: White Y: Yellow SB: Sky blue BR: Brown O: Orange GR: Gray
R: Red P: Pink V: Violet PU: Purple

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OPERATION

- The battery voltage is applied to the clutch switch (terminal No. 1) from the engine-ECU (terminal No. 44).

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FUNCTION

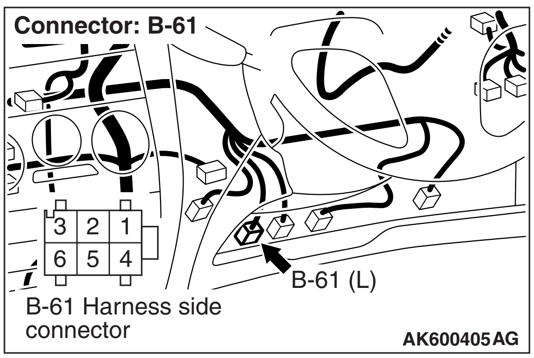
- Input, into the engine-ECU, the information whether the clutch pedal is depressed or not. When the clutch pedal is depressed to shift, the engine-ECU takes control to close the throttle valve and to retard the ignition timing.

PROBABLE CAUSES

- Failed clutch switch
- Open/short circuit and damage in clutch switch circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Connector check: B-61 clutch switch connector



Q: Is the check result normal?

YES : Go to Step 2 .

NO : Repair or replace the connector.

STEP 2. Check the clutch switch itself.

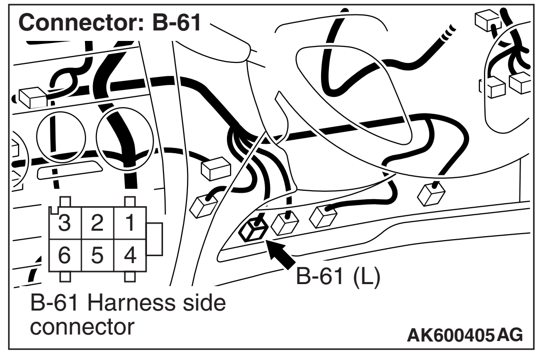
- Clutch switch check (Refer to GROUP 21A − Clutch − On-vehicle Service − Clutch monitor Switch Check and Adjustment P.21A-4).

Q: Is the check result normal?

YES : Go to Step 6 .

NO : Replace the clutch switch.

STEP 3. Perform voltage measurement at B-61 clutch switch connector.



- Disconnect connector, and measure at the harness side.
- Ignition switch: ON
- Voltage between terminal No. 1 and earth.

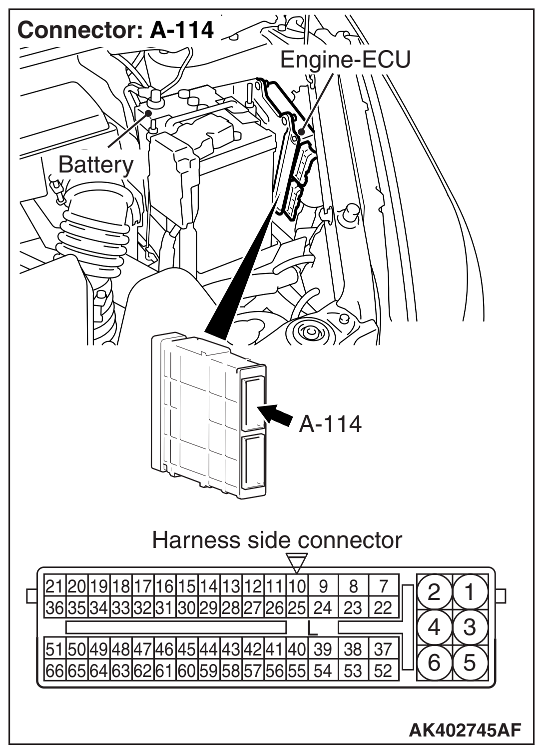
OK: System voltage

Q: Is the check result normal?

YES : Go to Step 6 .

NO : Go to Step 4 .

STEP 4. Connector check: A-114 engine-ECU connector



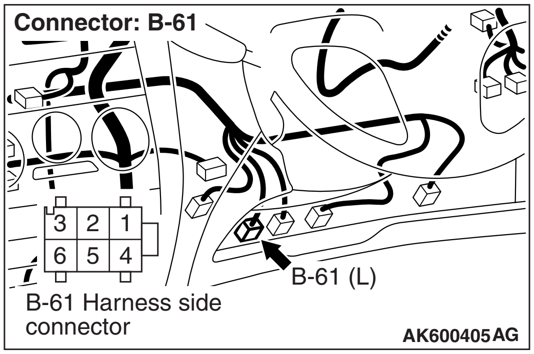
Q: Is the check result normal?

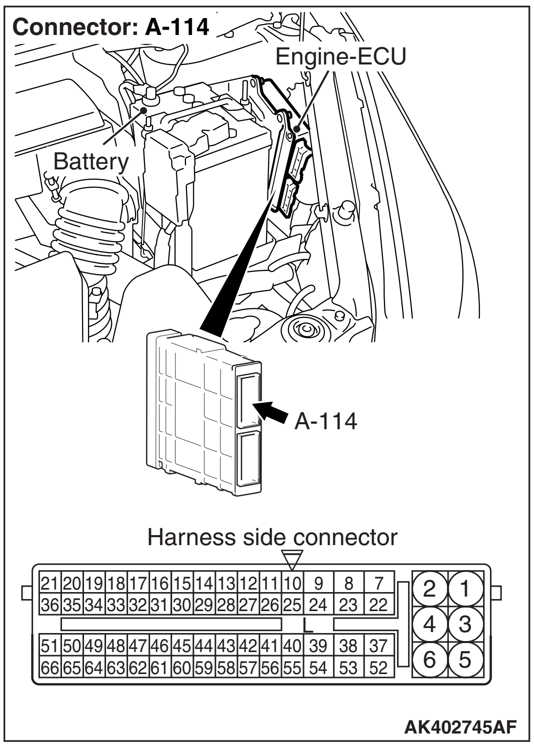
YES : Go to Step 5 .

NO : Repair or replace the connector.

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STEP 5. Check harness between B-61 (terminal No.1) clutch switch connector and A-114 (terminal No. 44) engine-ECU connector.

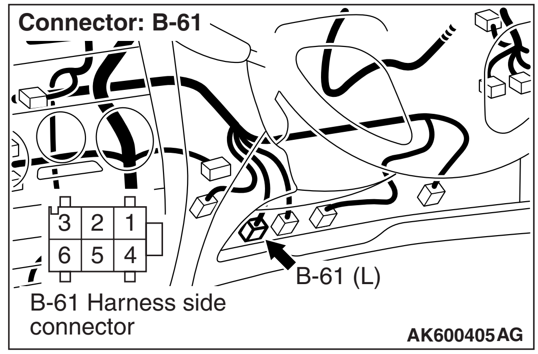




- Check intermediate connector A-17, and repair necessary.
- Check output line for open/short circuit.

Q: Is the check result normal?
YES : Replace engine-ECU.
NO : Repair.

STEP 6. Perform resistance measurement at B-61 clutch switch connector.

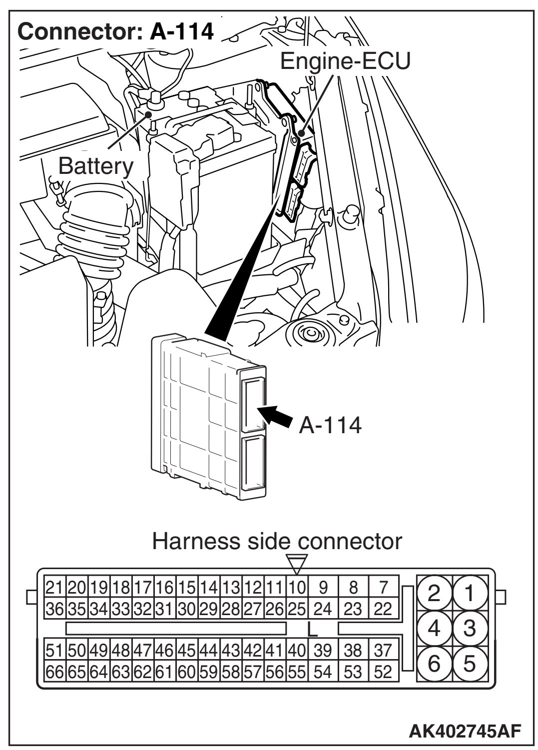


- Disconnect the connector, and measure at the harness side.
- Resistance between terminal No. 6 and earth.

OK: Continuity (2 Ω or less)

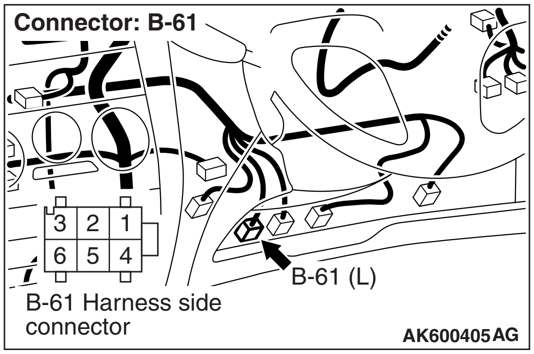
Q: Is the check result normal?
YES : Go to Step 7 .
NO : Check and repair harness between B-22 (terminal No. 6) clutch switch and body earth.
- Check earthing line for open circuit and damage.

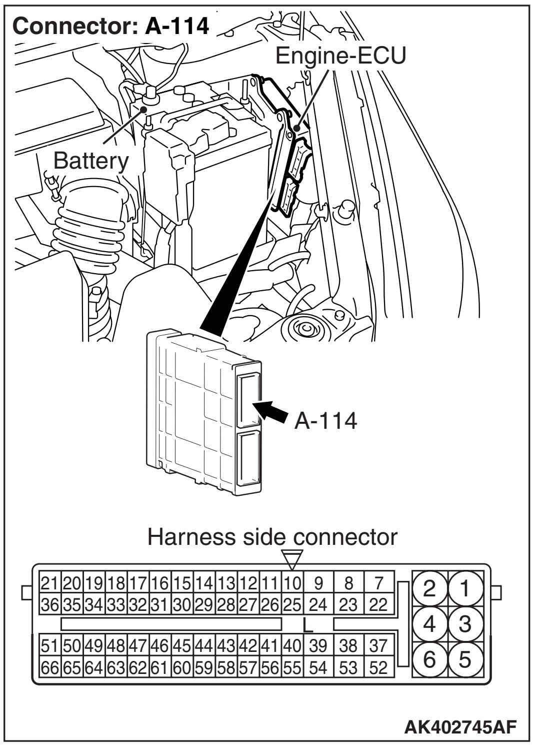
STEP 7. Connector check: A-114 engine-ECU connector.



Q: Is the check result normal?
YES : Go to Step 8 .
NO : Repair.

STEP 8. Check harness between B-61 (terminal No. 1) clutch switch connector and A-114 (terminal No. 44) engine-ECU connector.





- Check output line for damage.

Q: Is the check result normal?
YES : Replace engine-ECU.
NO : Repair.

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Data List Reference Table

M1131152002612

Item No.	Inspection item	Inspection condition		Normal condition	Inspection procedure No.	Reference page
11	Oxygen sensor (front)	Engine: After warm-up (leaner by deceleration, richer by acceleration)	Excessive deceleration from 4,000 r/min	200 mV or less	Code No. P0130	P.13B-65
			Excessive acceleration	→ 600 – 1,000 mV		
		Engine: After warm-up (using oxygen sensor, check air-fuel ratio as well as control status by engine-ECU.)	Idle operation	400 mV or less ⇔ 600 – 1,000 mV (varies)		
			2,500 r/min			
12	Air flow sensor*1	• Engine coolant temperature: 80 – 95°C • Lamps, electric cooling fan and all accessories: OFF • Transmission: Neutral	Idle operation	0.3 – 2.3 g/s	–	–
			2,500 r/min	2.1 – 8.1 g/s		
			Excessive acceleration	According to acceleration, flux is increased		
13	Intake air temperature sensor	Ignition switch: ON or engine running	Intake air temperature: –20°C	–20°C	Code No. P0110	P.13B-38
			Intake air temperature: 0°C	0°C		
			Intake air temperature: 20°C	20°C		
			Intake air temperature: 40°C	40°C		
			Intake air temperature: 80°C	80°C		

Item No.	Inspection item	Inspection condition		Normal condition	Inspection procedure No.	Reference page
14	Throttle position sensor (sub)	• Remove the intake air hose at the throttle body • Disconnect the connector of the electronic – controlled throttle valve • Connect only terminals No. 1, No. 2, No. 3 and No. 4 between disconnected connectors with the use of the special tool: MB991658 • Ignition switch: ON (engine stopped condition)	Fully close the throttle valve with your finger	4,300 – 4,700 mV	Code No. P0222, P0223	P.13B-112, P.13B-116
			Fully open the throttle valve with your finger	200 – 600 mV		
16	Power supply voltage	Ignition switch: ON		System voltage	Procedure No. 21	P.13B-282
18	Cranking signal (ignition switch-ST)	Ignition switch: ON		OFF	Procedure No. 21	P.13B-282
		Engine: Cranking		ON		
21	Engine coolant temperature sensor	Ignition switch: ON or engine running	Coolant temperature: –20°C	–20°C	Code No. P0115	P.13B-45
			Coolant temperature: 0°C	0°C		
			Coolant temperature: 20°C	20°C		
			Coolant temperature: 40°C	40°C		
			Coolant temperature: 80°C	80°C		

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Item No.	Inspection item	Inspection condition		Normal condition	Inspection procedure No.	Reference page
22	Crank angle sensor	• Engine: Cranking • Tachometer: Connected	Compare engine speed on tachometer with the value displayed on M.U.T.-III	Matched	–	–
		• Engine: Idle operation (At approximately 1 minute later from when the engine starting sequence is completed, the engine is in the steady state.) • Transmission: Neutral • A/C switch: OFF	Coolant temperature: –20°C	1,300 – 1,500 r/min		
			Coolant temperature: 0°C	1,290 – 1,490 r/min		
			Coolant temperature: 20°C	1,250 – 1,450 r/min		
			Coolant temperature: 40°C	1,160 – 1,360 r/min		
			Coolant temperature: 85°C	650 – 850 r/min		
25	Barometric pressure sensor	Ignition switch: ON	Altitude: 0 m	101 kPa	Code No. P0105	P.13B-37
			Altitude: 600 m	95 kPa		
			Altitude: 1,200 m	88 kPa		
			Altitude: 1,800 m	81 kPa		
37	Volumetric efficiency	• Engine coolant temperature: 80 – 95°C • Lamps, electric cooling fan and all accessories: OFF • Transmission: Neutral	Idle operation	6 – 26%	–	–
			2,500 r/min	6 – 26%		
			Excessive acceleration	According to acceleration, volumetric efficiency is increases		
41	Injector driving time*2	• Engine coolant temperature: 80 – 95°C • Lamps, electric cooling fan and all accessories: OFF • Transmission: Neutral	Idle operation	0.9 – 2.3 ms	–	–
			2,500 r/min	0.5 – 2.5 ms		
			Excessive acceleration	Increases		
44	Ignition advance value	• Engine coolant temperature: 80 – 95°C • Lamps, electric cooling fan and all accessories: OFF • Transmission: Neutral	Idle operation (At approximately 1 minute passes after the engine starting sequence is completed, and then the engine is in the steady state)	2 – 18°BTDC	–	–
			2,500 r/min	20 – 40°BTDC		

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Item No.	Inspection item	Inspection condition		Normal condition	Inspection procedure No.	Reference page
49	A/C compressor relay	Engine: After warm-up, idle operation	A/C switch: OFF	OFF	Procedure No. 24	P.13B-317
			A/C switch: ON (when the compressor clutch is operated)	ON		
59	Oxygen sensor (rear)	Engine: After warm-up, idle operation	At excessive acceleration	200 – 800 mV	Code No. P0136	P.13B-78
67	Stop lamp switch	Ignition switch: ON	Brake pedal: Depressed	ON	–	–
			Brake pedal: Released	OFF		
77	Accelerator pedal position sensor (sub)	Ignition switch: ON	Release the accelerator pedal	300 – 700 mV	Code No. P2127, P2128	P.13B-220, P.13B-224
			Depress the accelerator pedal	Increases in response to the pedal depression stroke		
			Depress the accelerator pedal fully	2,000 – 2,500 mV		
78	Accelerator pedal position sensor (main)	Ignition switch: ON	Release the accelerator pedal	800 – 1,200 mV	Code No. P2122, P2123	P.13B-212, P.13B-217
			Depress the accelerator pedal	Increases in response to the pedal depression stroke		
			Depress the accelerator pedal fully	4,000 – 4,800 mV		

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Item No.	Inspection item	Inspection condition		Normal condition	Inspection procedure No.	Reference page
79	Throttle position sensor (main)	• Remove the intake air hose at the throttle body • Disconnect the connector of the electronic-controlled throttle valve • Connect only terminals No. 1, No. 2, No. 3 and No. 4 between disconnected connectors with the use of the special tool: MB991658 • Ignition switch: ON	Fully close the throttle valve with your finger	300 – 700 mV	Code No. P0122, P0123	P.13B-53, P.13B-57
			Fully open the throttle valve with your finger	4,000 – 4,800 mV		
		• Engine coolant temperature: 80 – 95°C • Lamps, electric cooling fan and all accessories: OFF • Transmission: Neutral • Engine: Idle operation	No load	350 – 750 mV		
			A/C switch : OFF → ON	Voltage rises		
7E	Variable valve timing phase angle	Idling without load		0 – 5°CA	–	–
		Running with high load		The angle advance		
9E	Vehicle speed	Drive 40 km/h		Approximately 40 km/h	Code No. P0500	P.13B-166
12[*4]	Air flow sensor[*1]	• Engine coolant temperature: 80 – 95°C • Lamps, electric cooling fan and all accessories: OFF • Transmission: Neutral	Idle operation	0.3 – 2.3 g/s	–	–
			2,500 r/min	2.1 – 8.1 g/s		
			Excessive acceleration	Increases in response to acceleration		

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Item No.	Inspection item	Inspection condition		Normal condition	Inspection procedure No.	Reference page
13[*4]	Intake air temperature sensor	Ignition switch: ON or engine running	Intake air temperature: –20°C	–20°C	Code No. P0110	P.13B-38
			Intake air temperature: 0°C	0°C		
			Intake air temperature: 20°C	20°C		
			Intake air temperature: 40°C	40°C		
			Intake air temperature: 80°C	80°C		
21[*4]	Engine coolant temperature sensor	Ignition switch: ON or engine running	Coolant temperature: –20°C	–20°C	Code No. P0115	P.13B-45
			Coolant temperature: 0°C	0°C		
			Coolant temperature: 20°C	20°C		
			Coolant temperature: 40°C	40°C		
			Coolant temperature: 80°C	80°C		
22[*4]	Crank angle sensor	• Engine: Cranking • Tachometer: Connected	Compare engine speed on tachometer with the value displayed on M.U.T.-III	Matched	–	–
		• Engine: Idle operation (At approximately 1 minute later from when the engine starting sequence is completed, the engine is in the steady state.) • Transmission: Neutral • A/C switch: OFF	Coolant temperature: –20°C	1,350 – 1,550 r/min		
			Coolant temperature: 0°C	1,190 – 1,390 r/min		
			Coolant temperature: 20°C	950 – 1,150 r/min		
			Coolant temperature: 40°C	850 – 1,050 r/min		
			Coolant temperature: 85°C	650 – 850 r/min		
24[*4]	Vehicle speed signal	Drive 40 km/h		Approximately 40 km/h	Code No. P0500	P.13B-166

Item No.	Inspection item	Inspection condition		Normal condition	Inspection procedure No.	Reference page
44*4	Ignition advance value	• Engine coolant temperature: 80 – 95°C • Lamps, electric cooling fan and all accessories: OFF • Transmission: Neutral	Idle operation (At approximately 1 minute passes after the engine starting sequence is completed, and then the engine is in the steady state.)	2 – 18 deg	–	–
			2,500 r/min	20 – 40 deg		
8A*4	Throttle position sensor (throttle valve opening)	• Remove the intake air hose at the throttle body • Disconnect the connector of the electronic-controlled throttle valve • Connect only terminals No. 1, No. 2, No. 3 and No. 4 between disconnected connectors with the use of the special tool: MB991658 • Ignition switch: ON	Fully close the throttle valve with your finger	0 – 12%	Code No. P0122, P0123	P.13B-53, P.13B-57
			Fully open the throttle valve with your finger	75 – 100%		
A1*4	Oxygen sensor (front)	Engine: After warm-up (leaner by deceleration, richer by acceleration)	Excessive deceleration from 4,000 r/min	0.2 V or less	Code No. P0130	P.13B-65
			Excessive acceleration	0.6 – 1.0 V		
		Engine: After warm-up (using oxygen sensor, check air-fuel ratio as well as control status by engine-ECU)	Idle operation	0.4 V or less ⇔ 0.6 – 1 V (altered)		
			2,500 r/min			
A2*4	Oxygen sensor (rear)	Engine: After warm-up, idle operation	At excessive acceleration	200 – 800 mV	Code No. P0136	P.13B-78

*NOTE: *1: The airflow sensor output value may be approximately 10% higher when a vehicle is new (distance driven is less than 500 km).*

*NOTE: *2: The injector drive time is the time when the power voltage is 11 V and the cranking speed is 250 r/min or less.*

*NOTE: *3: The injector drive time may be approximately 10% longer when a vehicle is new (distance driven is less than 500 km).*

*NOTE: *4: This item is not displayed when the data list in check mode is selected.*

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Engine-ECU Monitor Item

- Items useful for grasping the engine control condition by the engine-ECU are provided in this monitor item section.
- Values of these monitor items vary greatly depending on marginal difference of measurement conditions, difference of the environment, aged deterioration of vehicles and so on, and it is difficult to show the precise specification values. Therefore, check conditions, display range and movement of values are described.

Item No.	Inspection item	Explanation of M.U.T. display	Guideline for inspection	Display range, numerical value
5A	Air-fuel ratio learning value of B zone (Low speed load)	• Shows compensation value that corrects air-fuel ratio feedback control under mid-to-high load • Minus side shows that injection amount decreases and plus side shows that it increases	Engine: After warm-up, drive at 40 km/h	−25 to 25%
5B	Idle speed control position learned value	• Shows compensation value that corrects idle speed control opening (throttle valve opening) • Minus side shows closed side and plus side shows open side	Ignition switch: ON	−128 to 127STEP
5C	Idle speed control position learned value (A/C load)	• Shows compensation value that corrects idle speed control opening (throttle valve opening) when A/C is ON • Minus side shows closed side and plus side shows open side	Ignition switch: ON	−128 to 127STEP
6A	Knock retard	• Shows retard amount of ignition timing controlled by detonation sensor output	Engine: Sudden acceleration after warm-up	Retards in response to accelerator opening
6B	Learned knock retard	• Shows compensation value that corrects ignition timing from detonation sensor output • 0% side shows retard and 100% side shows advance	Ignition switch: ON	0 – 100%
6C	Target Idle speed	• Shows target idle speed	Engine: Idle operation	Changes in response to engine coolant temperature
9B	Air-fuel ratio learning value of A zone (Low speed load)	• Shows compensation value that corrects air-fuel ratio feedback control under light load • Minus side shows that injection amount decreases and plus side shows that it increases	Engine: After warm-up, idle operation	−25 to 25%

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Item No.	Inspection item	Explanation of M.U.T. display	Guideline for inspection	Display range, numerical value
9D	Air-fuel ratio feedback integration	• Shows feedback amount of air-fuel ratio • Minus side shows that injection amount decreases and plus side shows that it increases	Engine: After warm-up, 2,500 r/min without any load	–25 to 25%
B1	Waste gate solenoid valve duty	• Shows duty ratio to wastegate solenoid valve	Engine: After warm-up	0 – 100%
B2	Alternator G terminal duty	• Shows duty ratio to alternator G terminal	Engine: After warm-up	0 – 100%
B3	Purge control solenoid valve duty	• Shows duty ratio to purge control solenoid valve	Engine: After warm-up	0 – 100%
81*	Long-term fuel compensatio n	• Shows compensation value that corrects air-fuel ratio feedback control under mid-to-high load • Minus side shows that injection amount decreases and plus side shows that it increases	Engine: After warm-up, 2,500 r/min without any load (Air-fuel ratio feedback control)	–25 to 25%
82*	Short-term fuel compensatio n	• Shows feedback amount of air-fuel ratio • Minus side shows that injection amount decreases and plus side shows that it increases	Engine: After warm-up, 2,500 r/min without any load (Air-fuel ratio feedback control)	–25 to 25%
87*	Calculation load value	• Shows magnitude of engine load	Engine: After warm-up	0 – 100%
88*	Fuel control condition	• Shows air-fuel ratio feedback control status OL: Open loop, CL: Closed loop OL-DRV: OL depending on driving condition OL-SYS: OL due to system failure CL-HO2: Closed loop only for front oxygen sensor (rear oxygen sensor abnormal) <in case of vehicle with rear oxygen sensor>	Engine: After warm-up	Changes depending on driving condition

*NOTE: *: This item is not displayed when the data list in check mode is selected.*

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Actuator Test Reference Table

M1131152501670

<table>
<tr><th>Item No.</th><th>Inspection item</th><th>Drive content</th><th colspan="2">Inspection conditions</th><th>Normal condition</th><th>Inspection procedure No.</th><th>Reference page</th></tr>
<tr><td>01</td><td rowspan="4">Injector</td><td>Cut off No. 1 injector</td><td colspan="2" rowspan="4">Engine: After warm-up, idle operation (Cut off injectors sequentially to check for a cylinder that does not change engine in idle status)</td><td rowspan="4">Engine is changed (becomes unstable or stalled)</td><td>Code No. P0201</td><td>P.13B-92</td></tr>
<tr><td>02</td><td>Cut off No. 2 injector</td><td>Code No. P0202</td><td>P.13B-97</td></tr>
<tr><td>03</td><td>Cut off No. 3 injector</td><td>Code No. P0203</td><td>P.13B-102</td></tr>
<tr><td>04</td><td>Cut off No. 4 injector</td><td>Code No. P0204</td><td>P.13B-107</td></tr>
<tr><td rowspan="2">07</td><td rowspan="2">Fuel pump</td><td rowspan="2">Drive fuel pump to circulate fuel</td><td rowspan="2">• Engine: Cranking
• Fuel pump: Forced drive
Inspect both conditions of the above</td><td>Pinch return hose with your fingers and feel pulsing flow of fuel with them</td><td>Feel pulsation</td><td rowspan="2">Procedure No. 22</td><td rowspan="2">P.13B-290</td></tr>
<tr><td>Check for pump operating noise near fuel tank</td><td>Operating noise is audible</td></tr>
<tr><td>08</td><td>Purge control solenoid valve</td><td>Switch solenoid valve from OFF to ON</td><td colspan="2">Ignition switch: ON</td><td>When the valve is actuated, operating noise is audible</td><td>Code No. P0443</td><td>P.13B-161</td></tr>
<tr><td>09</td><td>Fuel pressure solenoid valve</td><td>Switch solenoid valve from OFF to ON</td><td colspan="2">Ignition switch: ON</td><td>When the valve is actuated, operating noise is audible</td><td>Code No. P0090</td><td>P.13B-25</td></tr>
<tr><td>12</td><td>Waste gate solenoid valve</td><td>Switch solenoid valve from OFF to ON</td><td colspan="2">Ignition switch: ON</td><td>When the valve is actuated, operating noise is audible</td><td>Code No. P0243</td><td>P.13B-119</td></tr>
<tr><td>17</td><td>Basic ignition timing</td><td>Switch engine-ECU to ignition timing adjusting mode</td><td colspan="2">• Engine: Idle operation
• Install timing light</td><td>5° BTDC</td><td>–</td><td>–</td></tr>
</table>

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Item No.	Inspection item	Drive content	Inspection conditions	Normal condition	Inspection procedure No.	Reference page
20	Cooling fan motor (HI)	Fan motor is driven at high speed	Ignition switch: ON	Fan motor rotates at high speed	Procedure No. 23	P.13B-303
21	Cooling fan motor (LO)	Fan motor is driven at low speed	Ignition switch: ON	Fan motor rotates at low speed	Procedure No. 23	P.13B-303
34	Electronic-controlled throttle valve system	Stop the throttle valve control servo	Ignition switch: ON	Throttle valve is opened slightly	Code No. P0638	P.13B-174

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CHECK AT THE ECU TERMINALS

M1131155100140

TERMINAL VOLTAGE CHECK CHART

1. Disconnect the engine-ECU connector, and connect check harness special tool MB991987 between the engine-ECU connectors.
2. Measure the voltage between each check harness connector terminal and check harness connector earth terminal (No. 75 or No. 76).
3. Connect a needle-nosed wire probe to a voltmeter probe.
4. Referring to the check sheet, insert the micromini probe into the check harness connector and measure the voltage.

NOTE:
1. You may find it convenient to pull out the engine-ECU to make it easier to reach the connector terminals.
2. The checks can be carried out off the order given in the chart.

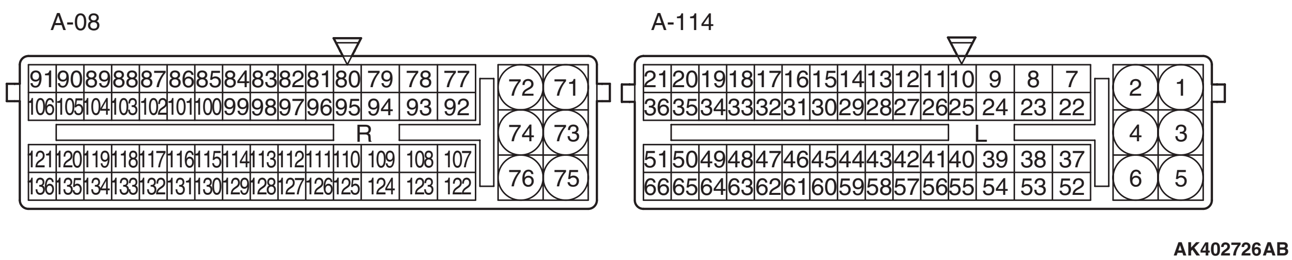
⚠ CAUTION

Short-circuiting the positive (+) probe between a connector terminal and earth could damage the vehicle wiring, the sensor, engine-ECU or all of them. Be careful to prevent this!

5. If voltmeter shows any division from standard value, check the corresponding sensor, actuator and related electrical wiring, then repair or replace.
6. After repair or replacement, recheck with the voltmeter to confirm that the repair has corrected the problem.

Engine-ECU Connector Terminal Arrangement

Special Tool Check Harness (MB991987) Connector Terminal Arrangement



Terminal No.	Check item	Check condition (Engine condition)	Normal condition
7	Throttle valve control servo (+)	• Ignition switch: ON • Accelerator pedal: fully opened → fully closed	Decreases slightly (approximately 2 V) from system voltage
8	No. 1 injector	Engine: While engine is idling after having warmed up, suddenly depress the accelerator pedal.	From 9 – 13 V momentarily drops slightly
9	No. 2 injector		
23	No. 3 injector		
24	No. 4 injector		
10	No. 1 ignition control	Engine: 3,000 r/min	0.1 – 2.0 V
25	No. 2 ignition control		
40	No. 3 ignition control		
55	No. 4 ignition control		
12	Camshaft position sensor	Engine: Cranking	2.0 – 4.8 V
		Engine: Idling	3.0 – 4.0 V
13	Crank angle sensor	Engine: Cranking	0.4 – 4.0 V
		Engine: Idling	2.0 – 3.0 V

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Terminal No.	Check item	Check condition (Engine condition)		Normal condition
14	Engine coolant temperature sensor	Ignition switch: ON	When engine coolant temperature is –20°C	3.9 – 4.5 V
			When engine coolant temperature is 0°C	3.2 – 3.8 V
			When engine coolant temperature is 20°C	2.3 – 2.9 V
			When engine coolant temperature is 40°C	1.3 – 1.9 V
			When engine coolant temperature is 60°C	0.7 – 1.3 V
			When engine coolant temperature is 80°C	0.3 – 0.9 V
15	Throttle position sensor (main)	• Remove the intake air hose at the throttle body • Disconnect the connector of the electronic-controlled throttle valve • Connect only terminals No. 1, No. 2, No. 3 and No. 4 between disconnected connectors with the use of the special tool: MB991658 • Ignition switch: ON (engine stopped condition)	Fully close the throttle valve with your finger	0.2 – 0.6 V
			Fully open the throttle valve with your finger	4.3 – 4.7 V

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Terminal No.	Check item	Check condition (Engine condition)		Normal condition
16	Throttle position sensor (sub)	• Remove the intake air hose at the throttle body • Disconnect the connector of the electronic-controlled throttle valve • Connect only terminals No. 1, No. 2, No. 3 and No. 4 between disconnected connectors with the use of the special tool: MB991658 • Ignition switch: ON (engine stopped condition)	Fully close the throttle valve with your finger	4.3 – 4.7 V
			Fully open the throttle valve with your finger	0.2 – 0.6 V
22	Throttle valve control servo (–)	• Ignition switch: ON • Accelerator pedal: fully closed → fully opened		Decreases slightly (approximately 2 V) from system voltage
31	Power supply voltage applied to throttle position sensor	Ignition switch: ON		4.9 – 5.1 V
34	Oxygen sensor (front)	Engine: Running at 2,500 r/min after warm-up		0.4 or less ⇔ 0.6 – 1.0 V (Changes repeatedly)
36	Waste gate solenoid valve	Ignition switch: ON		System voltage
		After warming up engine: Idle operation (when premium gasoline is used)		1 V or less
38	Purge control solenoid valve	Ignition switch: ON		System voltage
		Engine: After warming up, accelerate (4,000 r/min or less)		Voltage decreases
39	Ignition switch – ST	Engine: Cranking		8 V or more
51	Oxygen sensor (front) heater	Engine: Idling		1 V or less
		Engine: 5,000 r/min		System voltage
52	Oil feeder control valve	Ignition switch: ON		System voltage
		Operation at high load		4 – 10 V
57	Fuel pressure solenoid valve	Ignition switch: ON		System voltage
		Engine: Cranking → idle operation (within approximately 2 minutes)		1 V or less → System voltage
64	Alternator G terminal	• Engine: Idling after warm-up • Radiator fan: Inoperative • Headlamp switch: OFF → ON • Stop lamp: OFF → ON • Rear defogger switch: OFF → ON		Voltage increases by 0.2 – 3.5 V

Terminal No.	Check item	Check condition (Engine condition)		Normal condition
65	Alternator FR terminal	• Engine: Idling after warm-up • Radiator fan: Inoperative • Headlamp switch: OFF → ON • Stop lamp: OFF → ON • Rear defogger switch: OFF → ON		Voltage decreases
77	Power supply	Ignition switch: ON		System voltage
92				
78	Power supply for throttle valve control servo	Ignition switch: ON		System voltage
79	Oxygen sensor (rear) heater	Engine: Idling		1 V or less
		Engine: 5,000 r/min		System voltage
81	Fuel pump relay	Ignition switch: ON		System voltage
		Engine: Idling		1 V or less
82	Backup power supply	Ignition switch: "LOCK" (OFF)		System voltage
83	Accelerator pedal position sensor (main)	Ignition switch: ON	Release the accelerator pedal	0.8 – 1.2 V
			Depress the accelerator pedal fully	4.0 V or more
85	Power supply voltage applied to accelerator pedal position sensor (main)	Ignition switch: ON		4.9 – 5.1 V
86	Power supply voltage applied to accelerator pedal position sensor (sub)	Ignition switch: ON		4.9 – 5.1 V
88	Accelerator pedal position sensor (sub)	Ignition switch: ON	Release the accelerator pedal	0.3 – 0.7 V
			Depress the accelerator pedal fully	2.0 V or more
90	Airflow sensor	Raise engine speed gradually		Voltage rises with engine speed
95	Cooling fan control relay (Lo)	Fan inactive state		System voltage
		Fan low-speed rotation state		1 V or less
96	Cooling fan control relay (Hi)	Fan inactive state		System voltage
		Fan high-speed rotation state		1 V or less
97	Oxygen sensor (rear)	Engine: Running at 2,500 r/min after warmed up		0.2 – 0.8 V (After several seconds have elapsed)
107	Engine control relay	Ignition switch: "LOCK" (OFF)		System voltage
		Ignition switch: ON		1 V or less

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Terminal No.	Check item	Check condition (Engine condition)		Normal condition
110	A/C relay	• Engine: Idling • A/C switch: OFF → ON (A/C compressor is operating)		System voltage
122	Ignition switch - IG	Ignition switch: ON		System voltage
123	Throttle valve control servo relay	Ignition switch: "LOCK" (OFF)		0 – 0.1 V
		Ignition switch: ON		1 V or less
128	Stop lamp switch	Depress the brake pedal		System voltage
		Release the brake pedal		1 V or less
129	Intake air temperature sensor	Ignition switch: ON	When intake air temperature is –20°C	3.8 – 4.4 V
			When intake air temperature is 0°C	3.2 – 3.8 V
			When intake air temperature is 20°C	2.3 – 2.9 V
			When intake air temperature is 40°C	1.5 – 2.1 V
			When intake air temperature is 60°C	0.8 – 1.4 V
			When intake air temperature is 80°C	0.4 – 1.0 V

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CHECK CHART FOR RESISTANCE AND CONTINUITY BETWEEN TERMINALS

1. Turn the ignition switch to "LOCK" (OFF) position.
2. Disconnect the engine-ECU connector.
3. Measure the resistance and check for continuity between the terminals of the engine-ECU harness-side connector while referring to the check chart.

   NOTE:
   1. *When measuring resistance and checking continuity, a harness for checking contact pin pressure should be used instead of inserting a test probe.*
   2. *Checking need not be carried out in the order given in the chart.*

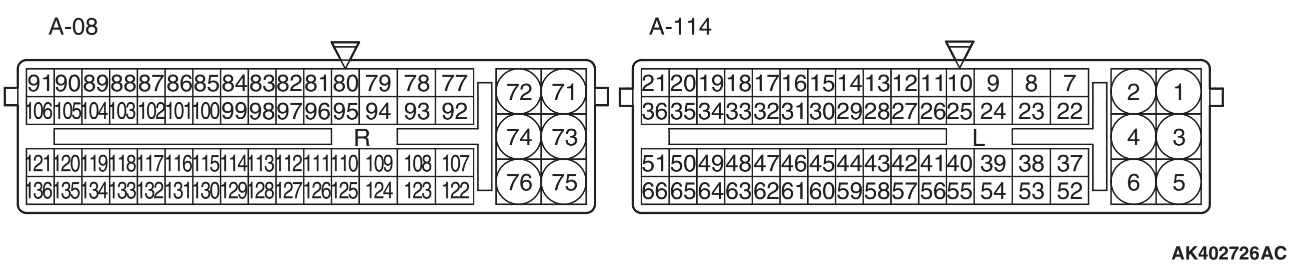
⚠ CAUTION

If the terminals that should be checked are mistaken, or if connector terminals are not correctly shorted to earth, damage may be caused to the vehicle wiring, sensors, engine-ECU and/or ohmmeter. Be careful to prevent this!

4. If the ohmmeter shows any deviation from the standard value, check the corresponding sensor, actuator and related electrical wiring, and the repair or replace.
5. After repair or replacement, recheck with the ohmmeter to confirm that the repair or replacement has corrected the problem.

Engine-ECU Harness Side Connector

Engine-CVT-ECU Harness Side Connector



Terminal No.	Inspection item	Normal condition (check condition)
7 – 22	Throttle valve control servo	0.3 – 100 Ω (at 20°C)
8 – 92	No. 1 injector	10.5 – 13.5 Ω (at 20°C)
9 – 92	No. 2 injector	
23 – 92	No. 3 injector	
24 – 92	No. 4 injector	
14 – 29	Engine coolant temperature sensor	14 – 17 kΩ (When engine coolant temperature is –20°C)
		5.1 – 6.5 kΩ (When engine coolant temperature is 0°C)
		2.1 – 2.7 kΩ (When engine coolant temperature is 20°C)
		0.9 – 1.3 kΩ (When engine coolant temperature is 40°C)
		0.48 – 0.68 kΩ (When engine coolant temperature is 60°C)
		0.26 – 0.36 kΩ (When engine coolant temperature is 80°C)
36 – 92	Waste gate solenoid valve	29 – 35 Ω (at 20°C)
38 – 92	Purge control solenoid valve	30 – 34 Ω (at 20°C)

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Terminal No.	Inspection item	Normal condition (check condition)
51 – 92	Oxygen sensor heater (front)	5 – 30 Ω (at 20°C)
52 – 92	Oil feeder control valve	6.9 – 7.9 Ω (at 20°C)
57 – 92	Fuel pressure solenoid valve	29 – 35 Ω (at 20°C)
75 – Body earth	ECU earth	Continuity (2 Ω or less)
76 – Body earth		
93 – Body earth		
108 – Body earth		
129 – 102	Intake air temperature sensor	13 – 17 kΩ (When intake air temperature is –20°C)
		5.4 – 6.6 kΩ (When intake air temperature is 0°C)
		2.3 – 3.0 kΩ (When intake air temperature is 20°C)
		1.0 – 1.5 kΩ (When intake air temperature is 40°C)
		0.56 – 0.76 kΩ (When intake air temperature is 60°C)
		0.31 – 0.43 kΩ (When intake air temperature is 80°C)
79 – 92	Oxygen sensor heater (rear)	5 – 30 Ω (at 20°C)

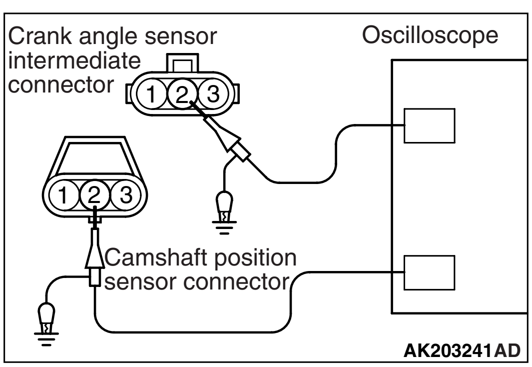
INSPECTION PROCEDURE USING OSCILLOSCOPE

M1131154501739

The output signals of the sensors and the conditions of the actuation signals of the actuators can be inspected visually by observing the waveforms on the oscilloscope.

CAMSHAFT POSITION SENSOR AND CRANK ANGLE SENSOR

Measurement Method



1. Disconnect the camshaft position sensor connector and connect the special tool test harness (MB991709) in between (All terminals should be connected).
2. Disconnect the crank angle sensor intermediate connector and connect the special tool test harness (MB991658) in between.
3. Connect the probe of each channel of the oscilloscope to camshaft position sensor connector terminal No. 2 and crank angle sensor intermediate connector terminal No. 2.

Alternate Method (Test harness not available)

1. Disconnect the engine-ECU connector and connect the special tool Power plant ECU check harness (MB991987) in between.
2. Connect the oscilloscope special patterns pickup to engine-ECU terminal No. 12 (When checking the camshaft position sensor signal wave pattern).
3. Connect the oscilloscope special patterns pickup to engine-ECU terminal No. 13 (When checking the crank angle sensor signal wave pattern).

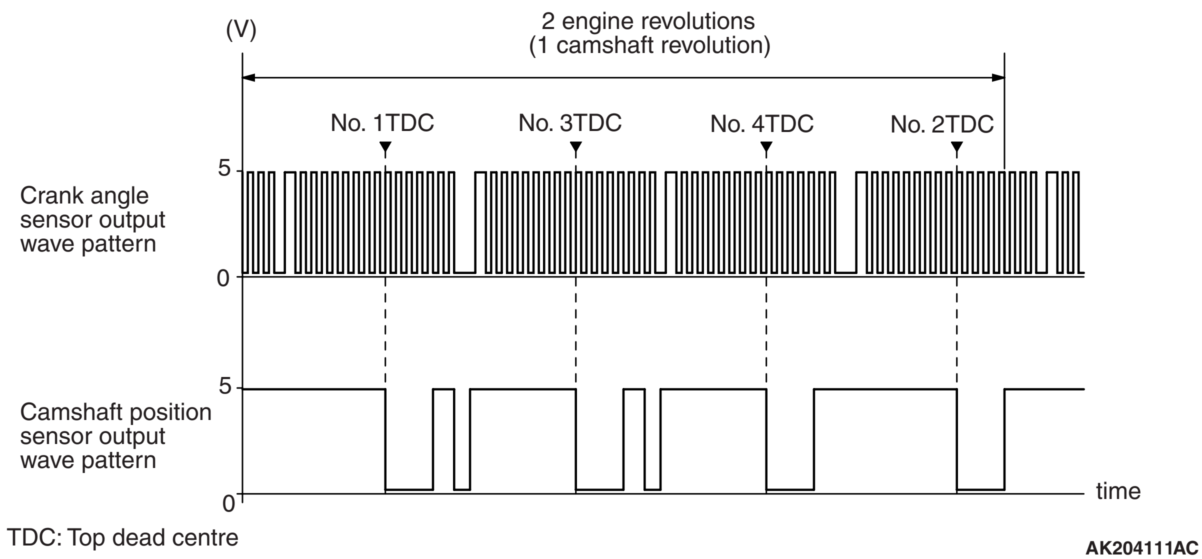
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Standard Wave Pattern

Observation condition

Function	Special patterns
Pattern height	Low
Pattern selector	Display
Engine	Idle

Standard wave pattern



Description of Wave Pattern

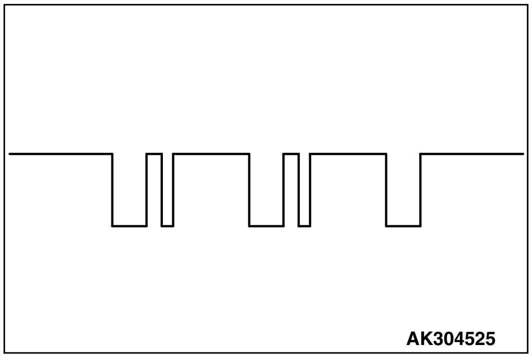
- The camshaft position sensor detects the compression top dead center of each cylinder. Observing this signal as well as other control signals simultaneously allows cylinder identification to be achieved.
- The crank angle sensor detects the crank angle of each cylinder. 72 crank angle sensor high signals (including missing tooth) are output at equal spaces per two revolutions of the engine.

Wave Pattern Observation Points

- Check that the wave pattern becomes shorter when the engine speed increases.

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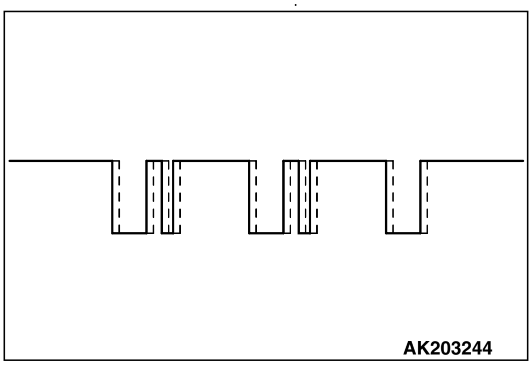
Examples of Abnormal Wave Patterns



Example 1

Wave pattern characteristics
Rectangular wave pattern is output even when the engine is not started.

Cause of problem
Sensor interface malfunction



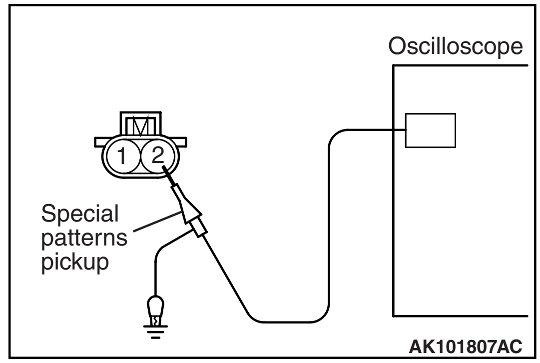
Example 2

Wave pattern characteristics
Wave pattern shifts left and right frequently.

Cause of problem
Loose timing belt
Abnormality in sensor disk

INJECTOR

Measurement Method



1. Disconnect the injector connector and connect the special tool test harness (MB991658) in between (All terminals should be connected).
2. Connect the probe of the oscilloscope to injector connector terminal No. 2.

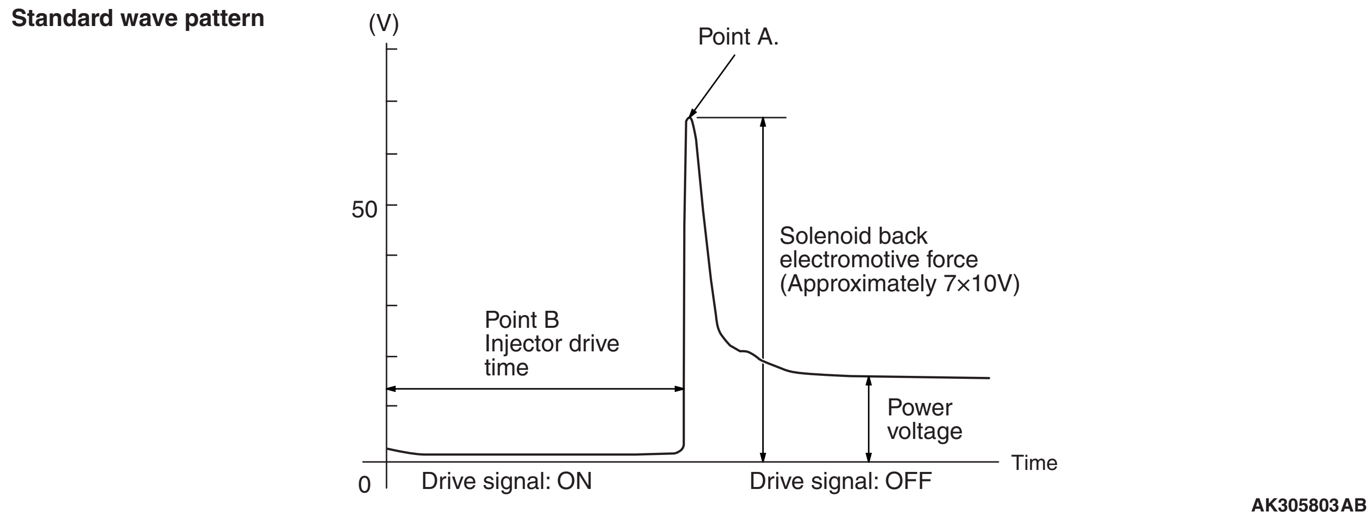
Alternate Method (Test harness not available)

1. Disconnect the engine-ECU connector and connect the special tool Power plant ECU check harness (MB991987) in between.
2. Connect the oscilloscope special patterns pickup to engine-ECU terminal No. 8 (When checking the No. 1 cylinder).
3. Connect the oscilloscope special patterns pickup to engine-ECU terminal No. 9 (When checking the No. 2 cylinder).
4. Connect the oscilloscope special patterns pickup to engine-ECU terminal No. 23 (When checking the No. 3 cylinder).
5. Connect the oscilloscope special patterns pickup to engine-ECU terminal No. 24 (When checking the No. 4 cylinder).

Standard Wave Pattern

Observation conditions

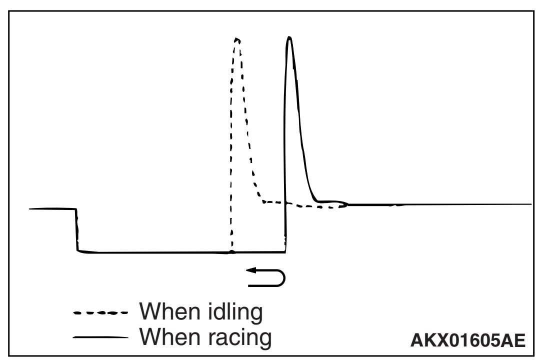
Function	Special patterns
Pattern height	Variable
Variable knob	Adjust while viewing the wave pattern
Pattern selector	Display
Engine	Idle



Description of Wave Pattern

- Normally the power voltage is applied, and when there is a signal from the engine-ECU, the voltage drops to near 0 V only for the drive signal time.
- When the signal from the engine-ECU is turned off, the peak of the voltage appears by the back electromotive force of the coil, and the voltage returns to the power voltage.
- Injector drive time: Fuel injection time determined by the engine-ECU according to output values of various sensors. Injector drive time = effective injection time + ineffective injection time (ineffective injection time: Corrects operation delay caused by a drop in the power voltage)
- Back electromotive force of solenoid coil: When the signal from the engine-ECU is turned off, a back electromotive force is generated in the injector coil (approximately 65 – 75 V).
- Power voltage: When there is no signal from the engine-ECU, the power voltage is applied. When this power voltage is low, the ineffective injection time becomes long, and the drive time also becomes long.

Wave Pattern Observation Points



Point A: Height of solenoid back electromotive force

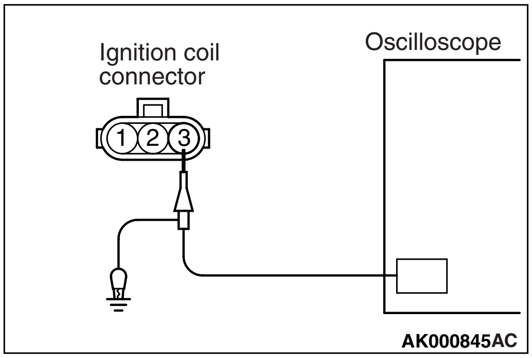
Contrast with standard wave pattern	Probable cause
Solenoid coil back electromotive force is low or does not appear at all.	Short in the injector solenoid

Point B: Injector drive time

- The injector drive time will be synchronized with the M.U.T.-III tester display.
- When the engine is suddenly raced, the drive time will be greatly extended at first, but the drive time will soon match the engine speed.

IGNITION COIL AND POWER TRANSISTOR

Measurement Method



1. Disconnect the ignition coil connector, and connect the special tool test harness (MB991658) in between (All terminals should be connected).
2. Connect the probe of the oscilloscope to ignition coil connector terminal No. 3.
3. To check the ignition advance condition, observe the crank angle sensor output signal simultaneously.

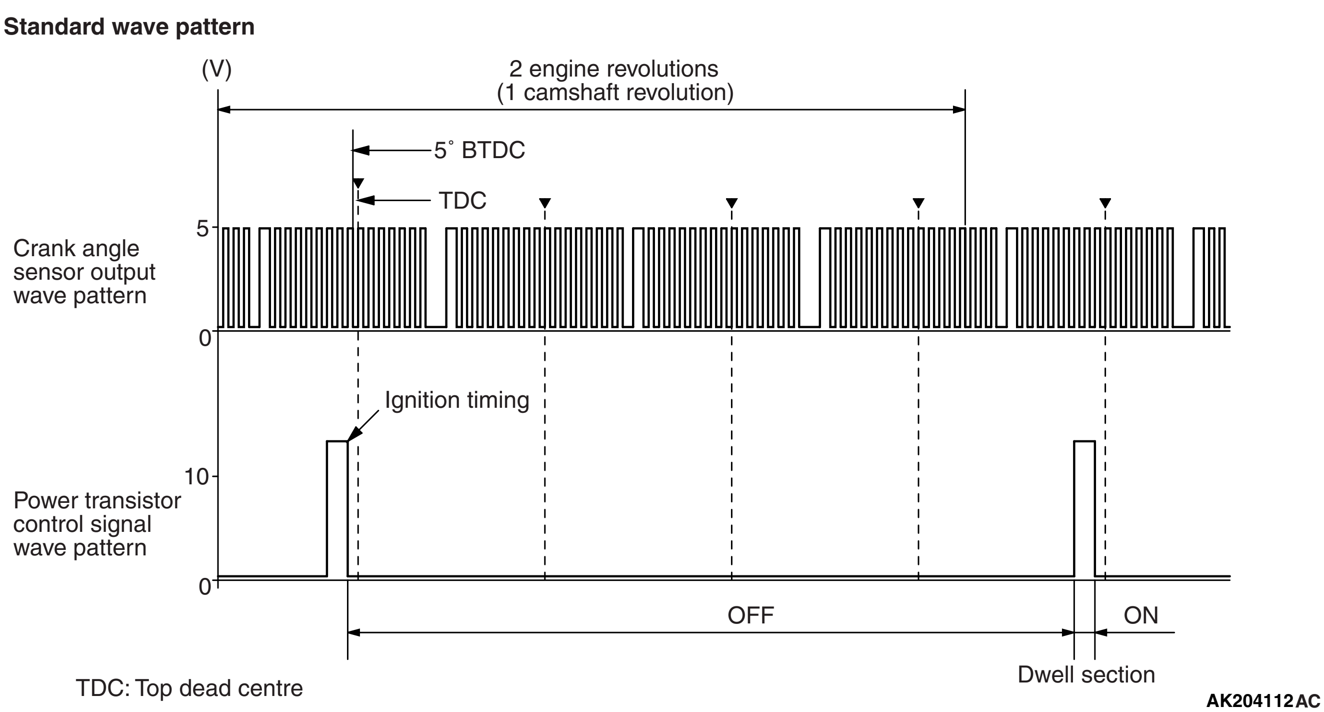
Alternate Method (Test harness not available)

1. Disconnect the engine-ECU connector and connect the special tool Power plant ECU check harness (MB991987) in between.
2. Connect the oscilloscope probe to engine-ECU terminal No. 10 (When checking the number 1 cylinder.)
3. Connect the oscilloscope probe to engine-ECU terminal No. 25 (When checking the number 2 cylinder.)
4. Connect the oscilloscope probe to engine-ECU terminal No. 40 (When checking the number 3 cylinder.)
5. Connect the oscilloscope probe to engine-ECU terminal No. 55 (When checking the number 4 cylinder.)

Standard Wave Pattern

Observation condition

Function	Special patterns
Pattern height	Low
Pattern selector	Display
Engine	Idle



Description of Wave Pattern

- Condition of power transistor being in ON:

Condition in which the power transistor is turned ON and power is applied to the ignition coil primary side (dwell section). The time for the passage of power becomes long when the battery voltage is low, and becomes short when the battery voltage is high. Thus, control is exercised so that the primary current becomes constant when ignition occurs.

- Condition of power transistor being in OFF:

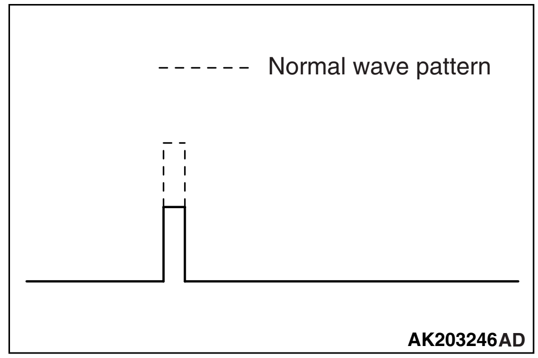
Condition in which the power transistor is turned OFF and no power transistor drive signal is output from the engine-ECU.

Wave Pattern Observation Points

- Check that the power transistor control signal (ignition timing) advances when the engine speed increases.

Example of Abnormal Wave Patterns

Wave pattern characteristics



Voltage is low.

Cause of problem

Open-circuit in ignition primary circuit

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ON-VEHICLE SERVICE

THROTTLE BODY (THROTTLE VALVE AREA) CLEANING

M1131001001142

1. Remove the air intake hose from the throttle body assembly.
2. Remove the throttle body assembly.

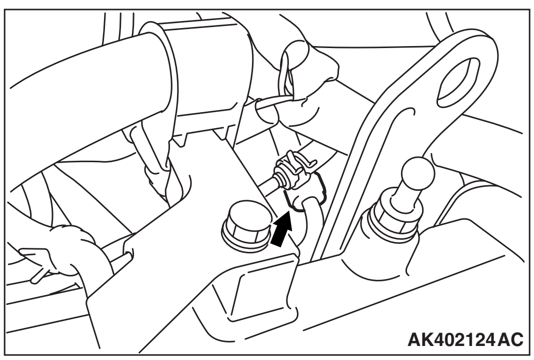
⚠ CAUTION
- **Do not spray the cleaning fluid directly to the throttle valve.**
- **Make sure that the cleaning fluid does not enter the motor and the sensor through the shaft.**

3. Spray cleaning fluid on a clean cloth.
4. Wipe off the dirt around the throttle valve with the cloth sprayed with cleaning fluid.
5. Install the throttle body assembly.
6. Attach the air intake hose.

FUEL PRESSURE TEST

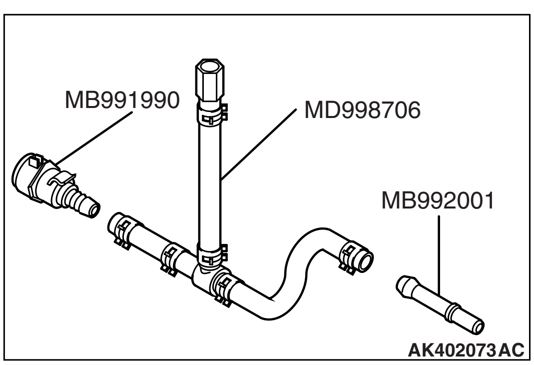
M1131001901510

1. Release residual pressure from the fuel pipe line to prevent fuel gush out (Refer to P.13B-360).



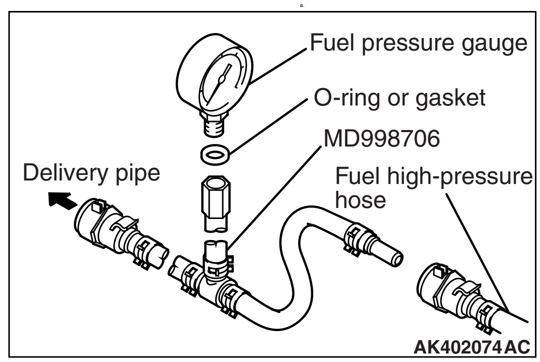
2. Disconnect the high-pressure fuel hose at the delivery pipe side.

⚠ CAUTION
Cover the hose connection with rags to prevent splash of fuel that could be caused by some residual pressure in the fuel pipe line.



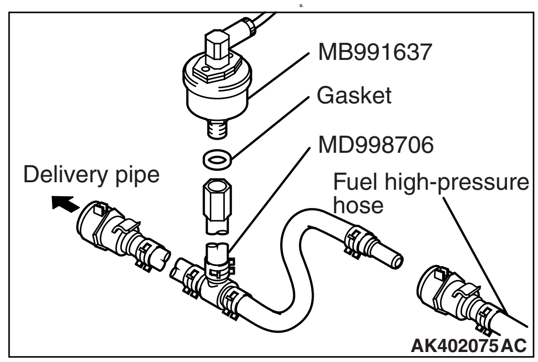
3. Assemble the special tool Injector test set (MD998706) as shown in the figure.
   a. Remove the mounting adapter for the injector and one side of another adapter.
   b. Attach the special tool Quick connector (MB991990) and the special tool Hose adapter (MB992001) to the hose from which the adapters have been removed.
4. Attach the special tool between the delivery hose and the high-pressure fuel hose.

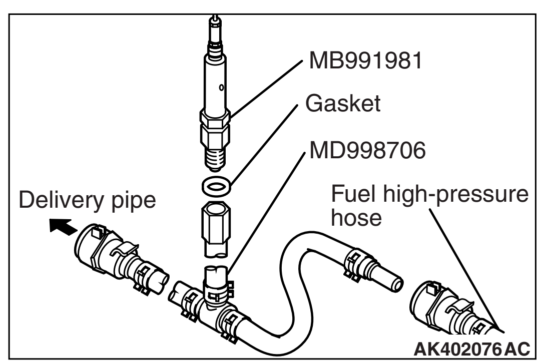
<When using the fuel pressure gauge>



Via a suitable O-ring or gasket, install the fuel pressure gauge to the special tool for fuel pressure measurement.

<When using the fuel pressure gauge set>





Via a gasket, install the special tool Fuel pressure gauge set (MB991637 or MB991981) into the special tool for fuel pressure measurement.

b. Connect lead wires of the fuel pressure gauge set to the power supply (cigarette lighter socket) and the special tool V.C.I. (MD991824).

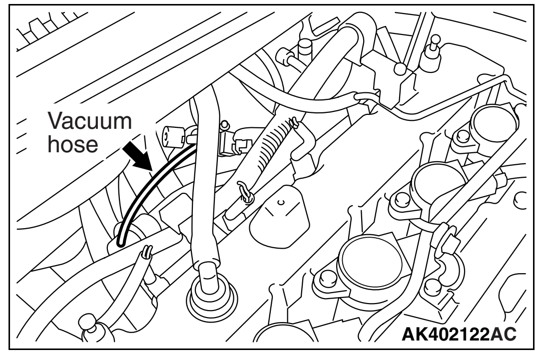
5. Connect the M.U.T.-III to the diagnosis connector.

⚠ CAUTION

Always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting the M.U.T.-III.

6. Turn the ignition switch to ON position (But do not start the engine).
7. Select "Item No. 07" from the M.U.T.-III actuator test to drive the fuel pump. Check that there are no fuel leaks from any parts under fuel pressure.
8. Finish the actuator test or turn the ignition switch to "LOCK" (OFF) position.
9. Start the engine and run at idle.
10. Measure fuel pressure while the engine is running at idle.

Standard value: Approximately 230 kPa



11. Remove the vacuum hose from the fuel pressure regulator, and measure fuel pressure while clogging the hose end with your finger.

Standard value: Approximately 289 – 299 kPa

12. Check to see that fuel pressure at idle does not drop even after the engine has been accelerated several times.
13. While repeating engine acceleration, lightly push the fuel return hose with your finger to check that there is fuel pressure also in the return hose.

NOTE: Fuel pressure in the return hose will be lost if a flow rate of fuel is insufficient.

14. If any of fuel pressure measurement in steps 9 to 12 is outside the standard value, troubleshoot and repair according to the table below.

Symptom	Probable cause	Remedy
• Fuel pressure too low • Fuel pressure drops after acceleration • No fuel pressure in fuel return hose	Clogged fuel filter	Replace fuel filter
	Fuel leaking to return side due to poor fuel regulator valve seating or settled spring	Replace fuel pressure regulator
	Low fuel pump delivery pressure	Replace fuel pump
Fuel pressure too high	Binding valve in fuel pressure regulator	Replace fuel pressure regulator
	Clogged fuel return hose or pipe	Clean or replace hose and pipe
Fuel pressure remains unchanged whether vacuum hose is connected or disconnected	Damaged vacuum hose or clogged nipple	Replace vacuum hose or clean nipple

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15. Stop the engine and check change of fuel pressure gauge reading. Normal if the reading does not drop within 2 minutes. If it does, observe the rate of drop and troubleshoot and repair according to the table below.

Symptom	Probable cause	Remedy
Fuel pressure drops gradually after engine is stopped	Leaky injector	Replace injector
	Leaky fuel pressure regulator valve seat	Replace fuel pressure regulator
Fuel pressure drops sharply immediately after engine is stopped	Check valve in fuel pump is held open	Replace fuel pump

16. Release residual pressure from the fuel pipe line.
17. Remove the special tool from the delivery pipe.

⚠ CAUTION

Cover the hose connection with rags to prevent splash of fuel that could be caused by some residual pressure in the fuel pipe line.

18. Fit the high-pressure fuel hose to the delivery hose.
19. Check for any fuel leaks by following the procedure in step 7.
20. Disconnect the M.U.T.-III.

FUEL PUMP CONNECTOR DISCONNECTION (HOW TO REDUCE PRESSURIZED LINES)

M1131000901357

⚠ *WARNING*

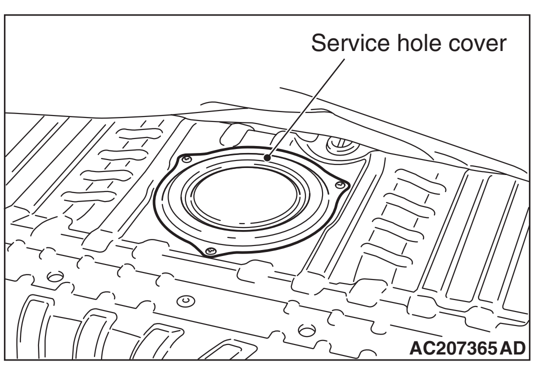
When removing the fuel pipe, etc., release fuel pressure to prevent fuel spray.

1. Lift up the rear seat assembly.

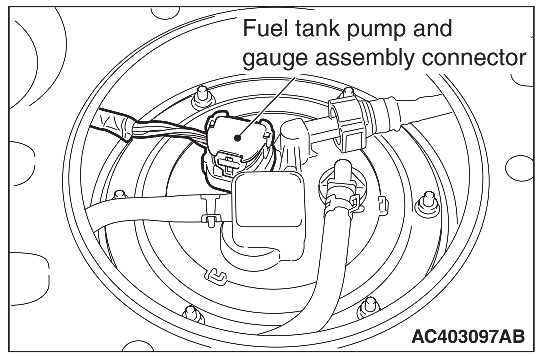
⚠ CAUTION

Moulding type of floor carpet is used. Be careful not to change the shape of carpet when turning it over for operation.

2. Remove the rear scuff plate, and turn over the floor carpet. (Refer to GROUP 52A, Interior Trims P.52A-11).



3. Remove the service hole cover.

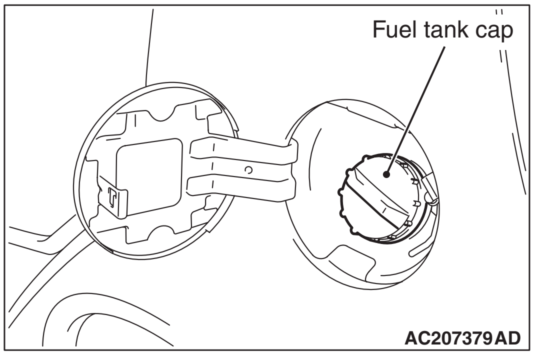


4. Disconnect the fuel tank pump and gauge assembly connector.
5. Crank the engine for at least two seconds.
6. If the engine is not started, turn the ignition switch to the "LOCK" (OFF) position.
7. If the engine is started, turn the ignition switch to the "LOCK" (OFF) position after the engine stopped.
8. Connect the fuel tank pump and gauge assembly connector.
9. Install the service hole cover.
10. Return the floor carpet to the original state, and install the rear scuff plate. (Refer to GROUP 52A, Interior Trims P.52A-11).
11. Return the rear seat assembly to the original state.

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FUEL TANK PUMP OPERATION CHECK

M1131002001510



1. Remove the fuel tank cap.

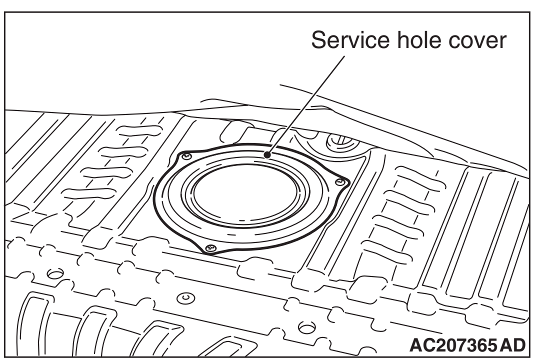
   NOTE: As the fuel tank pump is an in-tank type, the fuel tank pump sound is hard to hear. Then check the sound from the tank inlet.

2. Check the operating of the fuel tank pump by M.U.T.-III to force-drive the fuel tank pump.
3. Install the fuel tank cap.
4. If the fuel tank pump will not operate, check by using the following procedure. If normal, check the fuel tank pump drive circuit.
   (1) Turn the ignition switch to the "LOCK" (OFF) position.
   (2) Lift up the rear seat assembly.

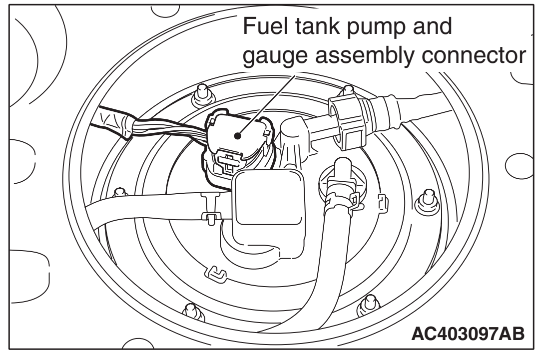
⚠ CAUTION

Moulding type of floor carpet is used. Be careful not to change the shape of carpet when turning it over for operation.

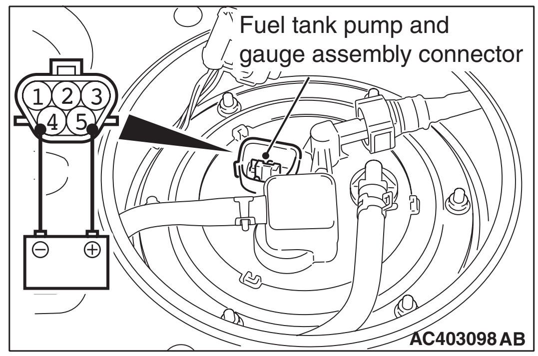
   (3) Remove the rear scuff plate, and turn over the floor carpet. (Refer to GROUP 52A, Interior Trims P.52A-11).



   (4) Remove the service hole cover.



   (5) Disconnect the fuel tank pump and gauge assembly connector.
   (6) Remove the fuel tank cap.



   (7) When the fuel tank pump and gauge assembly connector terminal is connected directly to the battery, check if the sound of the fuel tank pump operation can be heard. If no operating sound is heard, replace the fuel tank pump (Refer to GROUP 13C, On-vehicle Service P.13C-3).

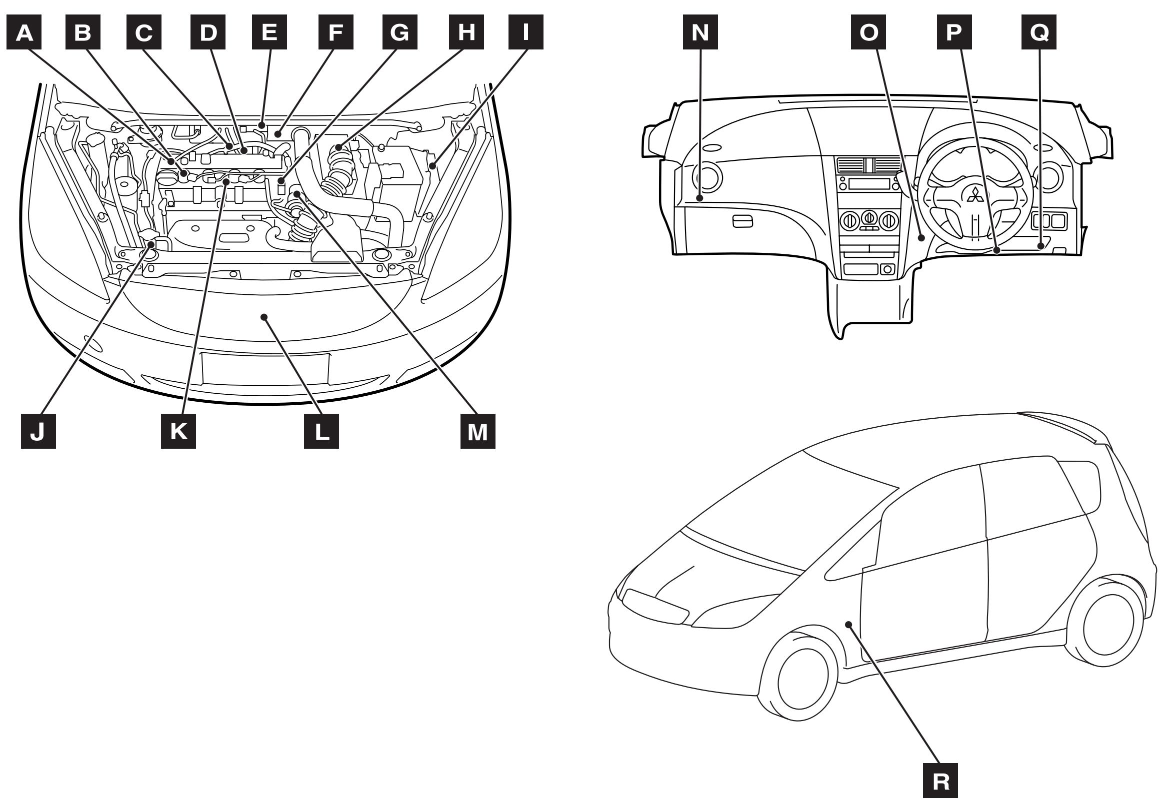
   NOTE: As the fuel tank pump is an in-tank type, the fuel tank pump sound is hard to hear. Then check the sound from the tank inlet.

   (8) Install the fuel tank cap.
   (9) Check for fuel pressure by pinching the fuel hose with fingertips.
   (10)Connect the fuel tank pump and gauge assembly connector.
   (11)Install the service hole cover.
   (12)Return the floor carpet to the original state, and install the rear scuff plate. (Refer to GROUP 52A, Interior Trims P.52A-11).
   (13)Return the rear seat assembly to the original state.

COMPONENT LOCATION

M1131002101799

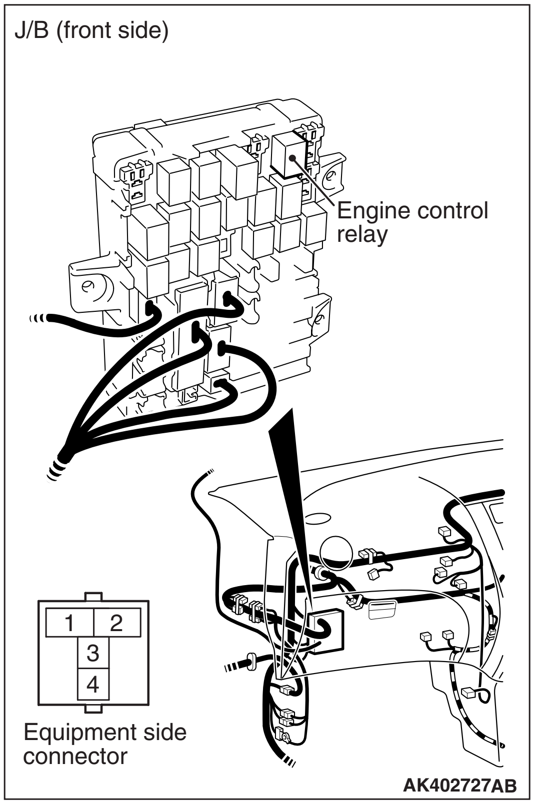
Name	Symbol	Name	Symbol
Accelerator pedal position sensor	Q	Fuel pump relay	N
Air flow sensor (with intake air temperature sensor)	H	Ignition coil (with power transistor)	B
A/C compressor relay	N	Injector	D
Camshaft position sensor	G	Oil feeder control valve	A
Cooling fan control relay	N	Oxygen sensor (front)	L
		Oxygen sensor (rear)	R
Crank angle sensor	J	Purge control solenoid valve	E
Detonation sensor	K	Stop lamp switch	P
Diagnosis connector	O	Throttle position sensor	F
Engine control relay	N	Throttle valve control servo	F
Engine coolant temperature sensor	M	Throttle valve control servo relay	N
Engine-ECU (with barometric pressure sensor)	I	Waste gate solenoid valve	M
Fuel pressure control solenoid valve	C		



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ENGINE CONTROL RELAY CONTINUITY CHECK

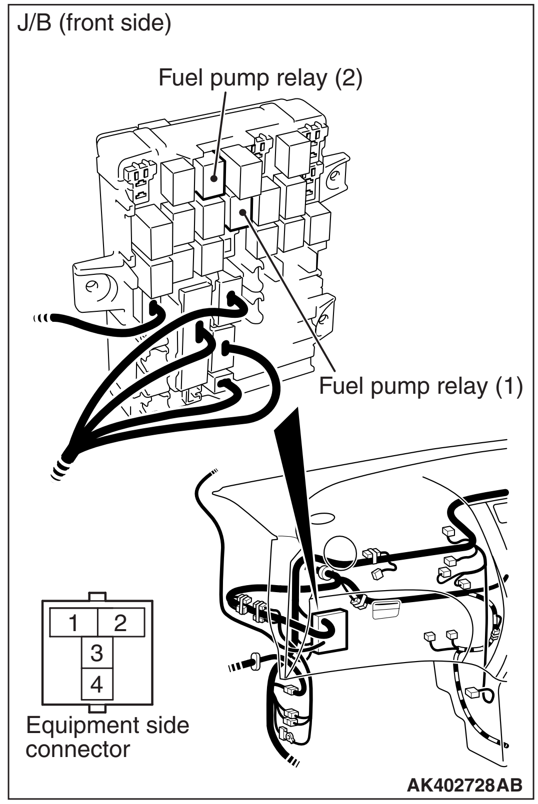
M1131050000914



Tester Connection Terminal	Battery Voltage	Normal State
1 – 2	No voltage	Continuity
3 – 4	No voltage	No continuity
	Voltage (Connect positive (+) terminal of battery to terminal No. 1 and negative (–) terminal of battery to terminal No. 2.)	Continuity

FUEL PUMP RELAY CONTINUITY CHECK

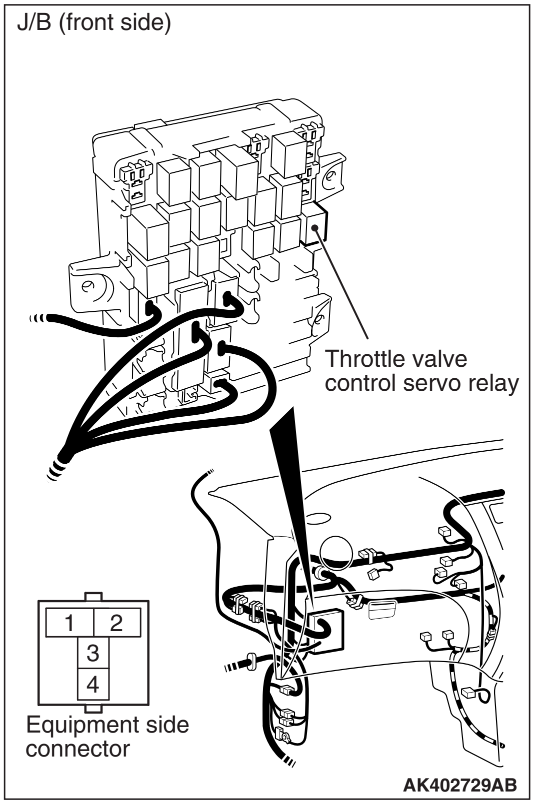
M1131033000632



Tester Connection Terminal	Battery Voltage	Normal State
1 – 2	No voltage	Continuity
3 – 4	No voltage	No continuity
	Voltage (Connect positive (+) terminal of battery to terminal No. 1 and negative (–) terminal of battery to terminal No. 2.)	Continuity

THROTTLE VALVE CONTROL SERVO RELAY CONTINUITY CHECK

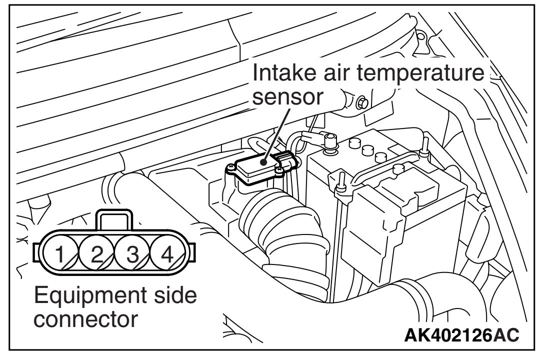
M1131053500134



Tester Connection Terminal	Battery Voltage	Normal State
1 – 2	No voltage	Continuity
3 – 4	No voltage	No continuity
	Voltage (Connect positive (+) terminal of battery to terminal No. 1 and negative (–) terminal of battery to terminal No. 2.)	Continuity

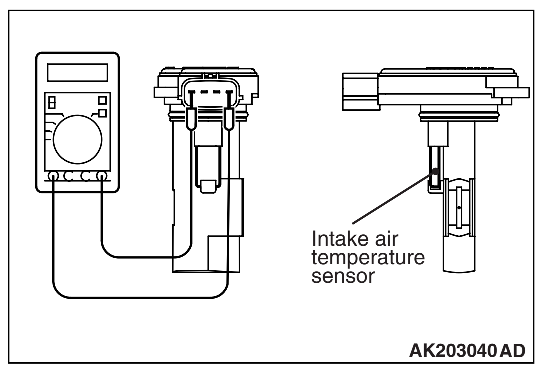
INTAKE AIR TEMPERATURE SENSOR CHECK

M1131002800944



1. Disconnect the air flow sensor connector.
2. Measure resistance between terminals No. 1 and No. 4.

   Standard value:
   13 – 17 kΩ (at –20°C)
   5.4 – 6.6 kΩ (at 0°C)
   2.3 – 3.0 kΩ (at 20°C)
   1.0 – 1.5 kΩ (at 40°C)
   0.56 – 0.76 kΩ (at 60°C)
   0.31 – 0.43 kΩ (at 80°C)
3. Remove the air flow sensor.



4. Measure resistance while heating the sensor using a hair drier.

   Normal condition:

Temperature (°C)	Resistance (kΩ)
Higher	Smaller

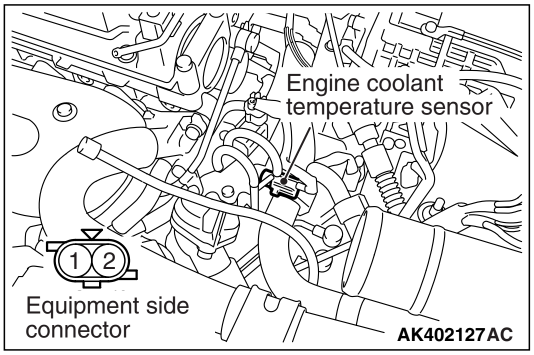
5. If the value deviates from the standard value or the resistance remains unchanged, replace the air flow sensor assembly.
6. Install the air flow sensor and tighten it to the specified torque.

   Tightening torque: 1.8 ± 0.6 N·m

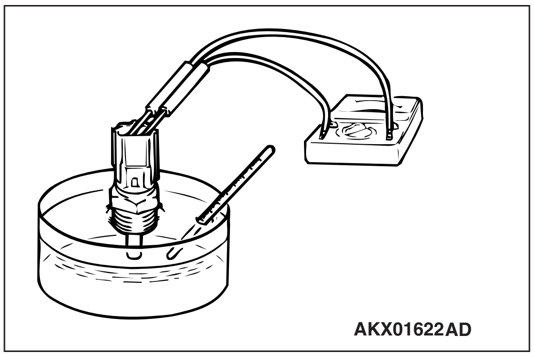
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ENGINE COOLANT TEMPERATURE SENSOR CHECK

M1131003100896



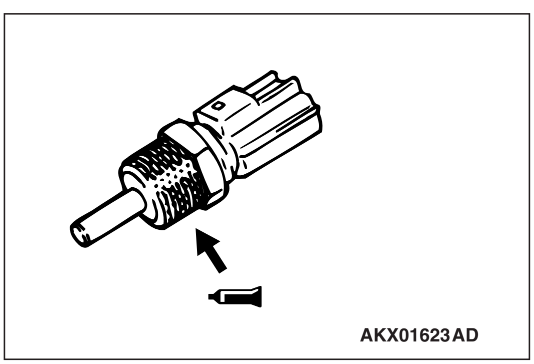
1. Remove the engine coolant temperature sensor.



2. With temperature sensing portion of engine coolant temperature sensor immersed in hot water, check resistance between the terminals of the connector.

   Standard value:
   14 – 17 kΩ (at –20°C)
   5.1 – 6.5 kΩ (at 0°C)
   2.1 – 2.7 kΩ (at 20°C)
   0.9 – 1.3 kΩ (at 40°C)
   0.48 – 0.68 kΩ (at 60°C)
   0.26 – 0.36 kΩ (at 80°C)

3. If the value deviates from the standard value or the resistance remains unchanged, replace the engine coolant temperature sensor.



4. Apply sealant to the thread portion.

   Specified sealant: 3M NUT Locking Part No. 4171 or equivalent

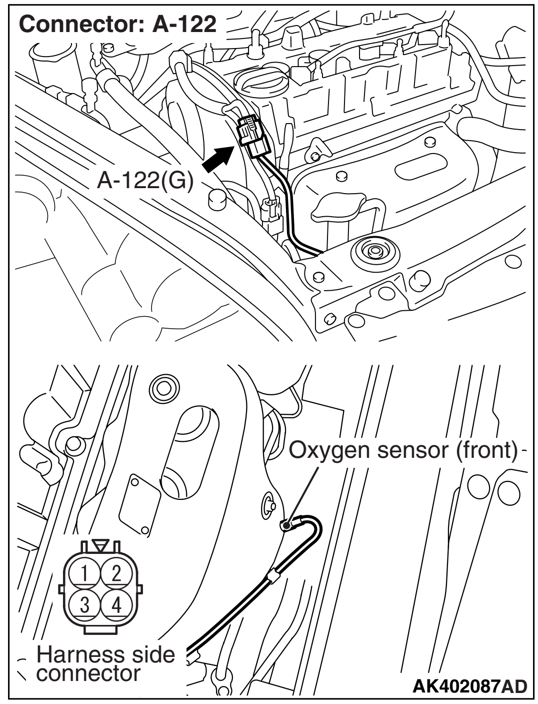
5. Install the engine coolant temperature sensor and tighten it to the specified torque.

   Tightening torque: 29 ± 10 N·m

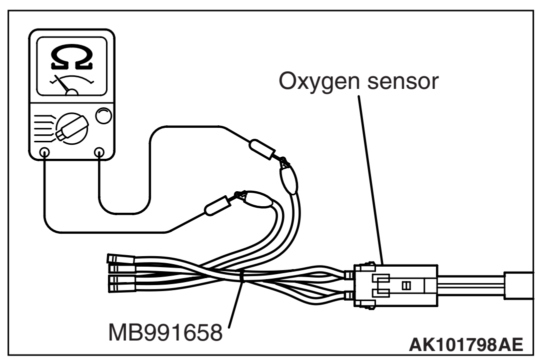
OXYGEN SENSOR CHECK

M1131005001638

OXYGEN SENSOR (FRONT)



1. Disconnect the oxygen sensor connector and connect the special tool Test harness (MB991658) to the connector on the oxygen sensor side.

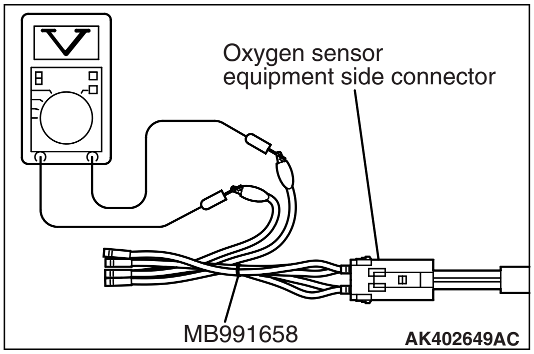


2. Measure resistance between terminal No. 3 and terminal No. 4 of the oxygen sensor connector.

   Standard value: 5 – 30 Ω (at 20°C)

3. If there is no continuity, replace the oxygen sensor.
4. Warm up the engine until engine coolant is 80°C or higher.
5. Perform a tracing for 5 minutes or more with the engine speed of 4,500 r/min.

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6. Connect a digital voltage meter between terminal No. 1 and No. 2.
7. While repeatedly racing the engine, measure the oxygen sensor output voltage.

Standard value:

Engine	Oxygen sensor output voltage	Remarks
When racing the engine	0.6 – 1.0 V	If you make the air-fuel ratio rich by racing the engine repeatedly, a normal oxygen sensor will output a voltage of 0.6 – 1.0 V.

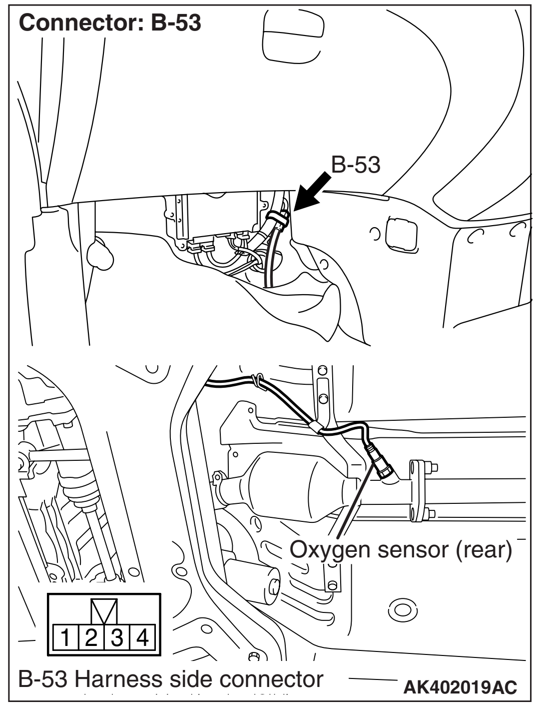
⚠ **CAUTION**
- **Be very careful when connecting the jumper wire; incorrect connection can damage the oxygen sensor.**
- **Be careful the heater is broken when voltage of beyond 12 V is applied to the oxygen sensor heater.**

NOTE: If the sufficiently high temperature (of approximate 400°C or more) is not reached although the oxygen sensor is normal, the output voltage would be possibly low although the rich air-fuel ratio. Therefore, if the output voltage is low, use a jumper wire to connect the terminal No. 3 and the terminal No. 4 of the oxygen sensor with a (+) terminal and (–) terminal of 12 V power supply respectively, then check again.

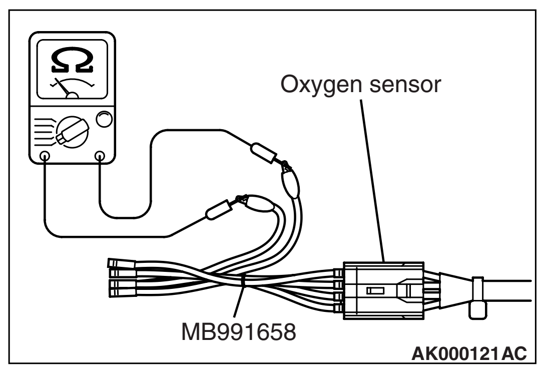
8. If the sensor is defective, replace the oxygen sensor.

NOTE: For removal and installation of the oxygen sensor, refer to GROUP 15 – Exhaust Pipe and Main Muffler – Exhaust Pipe and Main Muffler Removal and installation P.15-21.

OXYGEN SENSOR (REAR)



1. Disconnect the oxygen sensor connector and connect the special tool Test harness (MB991658) to the connector on the oxygen sensor side.

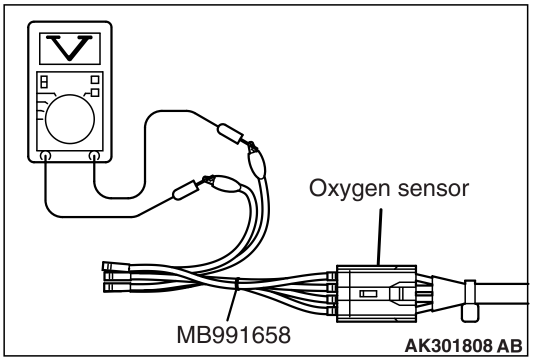


2. Measure resistance between terminal No. 3 and terminal No. 4 of the oxygen sensor connector.

   Standard value: 5 – 30 Ω (at 20°C)

3. If there is no continuity, replace the oxygen sensor.
4. Warm up the engine until engine coolant is 80°C or higher.
5. Perform a tracing for 5 minutes or more with the engine speed of 4,500 r/min.

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6. Connect a digital voltage meter between terminal No.1 and No. 2.
7. While repeatedly racing the engine, measure the oxygen sensor output voltage.

Standard value:

Engine	Oxygen sensor output voltage	Remarks
When racing the engine	0.6 – 1.0 V	If you make the air-fuel ratio rich by racing the engine repeatedly, a normal oxygen sensor will output a voltage of 0.6 – 1.0 V.

⚠ CAUTION

- **Be very careful when connecting the jumper wire; incorrect connection can damage the oxygen sensor.**
- **Be careful the heater is broken when voltage of beyond 12 V is applied to the oxygen sensor heater.**

NOTE: If the sufficiently high temperature (of approximate 400°C or more) is not reached although the oxygen sensor is normal, the output voltage would be possibly low although the rich air-fuel ratio. Therefore, if the output voltage is low, use a jumper wire to connect the terminal No. 4 and the terminal No. 3 of the oxygen sensor with a (+) terminal and (–) terminal of 12 V power supply respectively, then check again.

8. If the sensor is defective, replace the oxygen sensor.

NOTE: For removal and installation of the oxygen sensor, refer to GROUP 15 – Exhaust Pipe and Main Muffler – Exhaust Pipe and Main Muffler Removal and installation P.15-21.

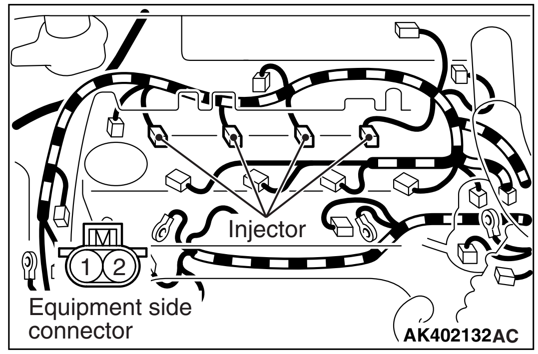
INJECTOR CHECK

M1131005201041

CHECK THE OPERATION SOUND

⚠ CAUTION

Beware that the operation sounds of other injectors can be heard even if the injector that is being inspected might not be operating.



1. Use a stethoscope to listen to the operating sound (clicking) of the injectors while the engine is idling or cranking.
2. Verify that the operating sound increases with the engine speed.

NOTE: If the operating sound cannot be heard, inspect the injector actuation circuit.

MEASUREMENT OF RESISTANCE BETWEEN TERMINALS

1. Disconnect the injector connector.
2. Measure the resistance between terminals.

   Standard value: 10.5 – 13.5 Ω (at 20°C)

3. If the obtained value is outside the standard value, replace the injector (Refer to P.13B-370).

CHECK THE INJECTION CONDITION

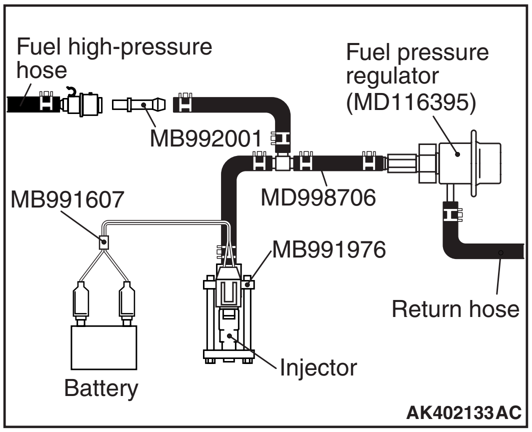
1. Release residual pressure from the fuel pipe line to prevent fuel gush out (Refer to P.13B-360).

⚠ CAUTION

Cover the hose connection with rags to prevent splash of fuel that could be caused by some residual pressure in the fuel pipe line.

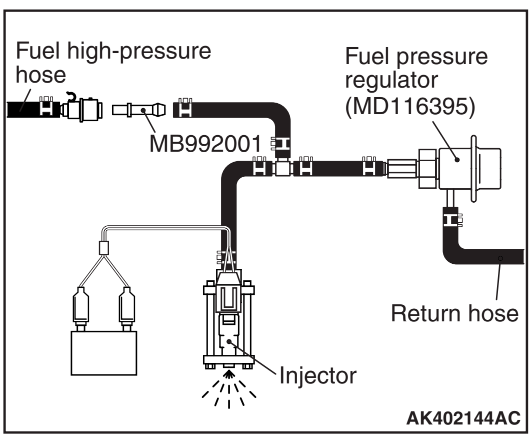
2. Remove the high-pressure fuel hose at the delivery pipe side.
3. Remove the injector.

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4. Install the injector using the following special tools as shown in the figure.
   - Injector test harness (MB991607)
   - Injector holder (MB991976)
   - Injector test set (MD998706)*
   - Hose adapter (MB992001)

   *NOTE: *:Of adapters other than the mounting adapter for the injector, remove one side of the adapter.*
5. Connect the M.U.T.-III to the diagnosis connector.
6. Turn the ignition switch to "ON" position (but do not start the engine).
7. Select "Item No. 07" from M.U.T.-III actuator test and drive the fuel pump.



8. Actuate the injector and check the fuel spray condition. The condition can be considered satisfactory unless it is extremely poor.
9. Stop actuating the injector and check leakage from the injector nozzle.

   Standard value: one drop or less/minute
10. Turn the ignition switch to "LOCK" OFF position, and then disconnect the M.U.T.-III.
11. Actuate the injector until the fuel cannot flow. Draw the fuel out from the special tool.
12. Remove the special tool.
13. If the fuel spray condition is extremely poor or if there is the fuel leakage from the injector nozzle, replace the injector.
14. Install the injector and high-pressure fuel hose.
15. Remove the M.U.T.-III.

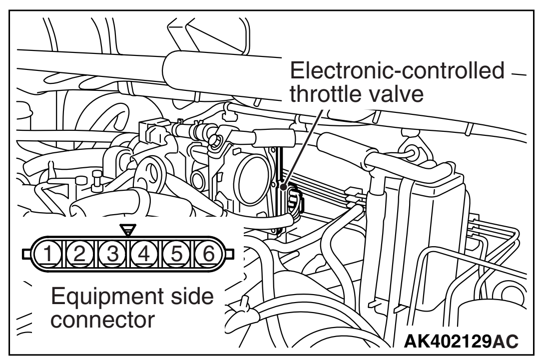
THROTTLE VALVE CONTROL SERVO CHECK

M1131051000315

OPERATION CHECK

1. Remove the air intake hose from the throttle body.
2. Turn the ignition switch to ON position.
3. Operate the accelerator pedal and check that the throttle valve opens and closes accordingly.

CHECK THE COIL RESISTANCE



1. Disconnect the electronic-controlled throttle valve connector.
2. Measure the resistance between terminals No. 5 and No. 6 at the electronic-controlled throttle valve connector.

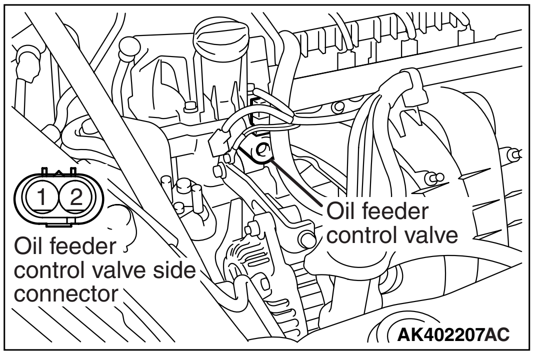
   Standard value: 0.3 – 100 Ω (at 20°C)
3. If the resistance is outside the standard value, replace the throttle body assembly.

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OIL FEEDER CONTROL VALVE CHECK

M1131053800061

OPERATION CHECK



1. Disconnect the oil feeder control valve connector.

⚠ CAUTION

To prevent the coil from burning, keep the duration of the voltage application as short as possible.

2. Apply battery voltage to the terminals of the connector at the oil feeder control valve, and make sure the oil feeder control valve makes a clicking sound.

MEASUREMENT OF RESISTANCE BETWEEN TERMINALS

1. Disconnect the oil feeder control valve connector.
2. Measure the resistance between the terminals of the connector at the oil feeder control valve.

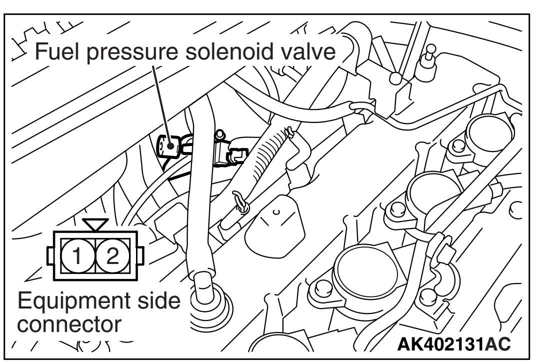
   Standard value: 6.9 – 7.9 Ω (at 20°C)

3. If resistance is outside the standard value, replace the oil feeder control valve.

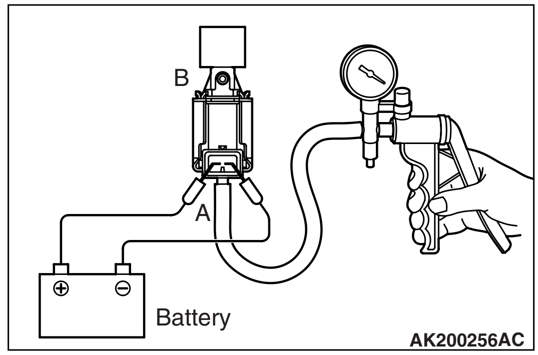
FUEL PRESSURE SOLENOID VALVE CHECK

M1131053700031

OPERATION CHECK



1. Remove the vacuum hose from the solenoid valve.
2. Disconnect the harness connector.

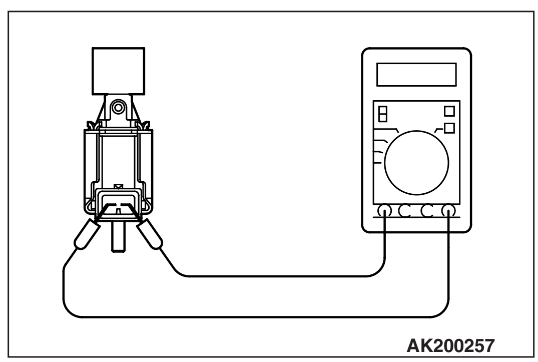


3. Connect the hand vacuum pump to nipple A of the solenoid valve.
4. Use a jumper wire to connect the solenoid terminals to the battery terminals.
5. Interrupt the jumper wire on the battery (–) terminal side and apply negative pressure to check for airtightness.

   Standard value:

Jumper wire	Condition of nipple B	Normal condition
Disconnect	Open	Negative pressure leaks
	Blocked	Negative pressure is retained
Connect	Open	Negative pressure is retained

COIL RESISTANCE CHECK



1. Measure the resistance between terminals of the solenoid valve.

   Standard value: 29 – 35 Ω (at 20 °C)

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INJECTOR

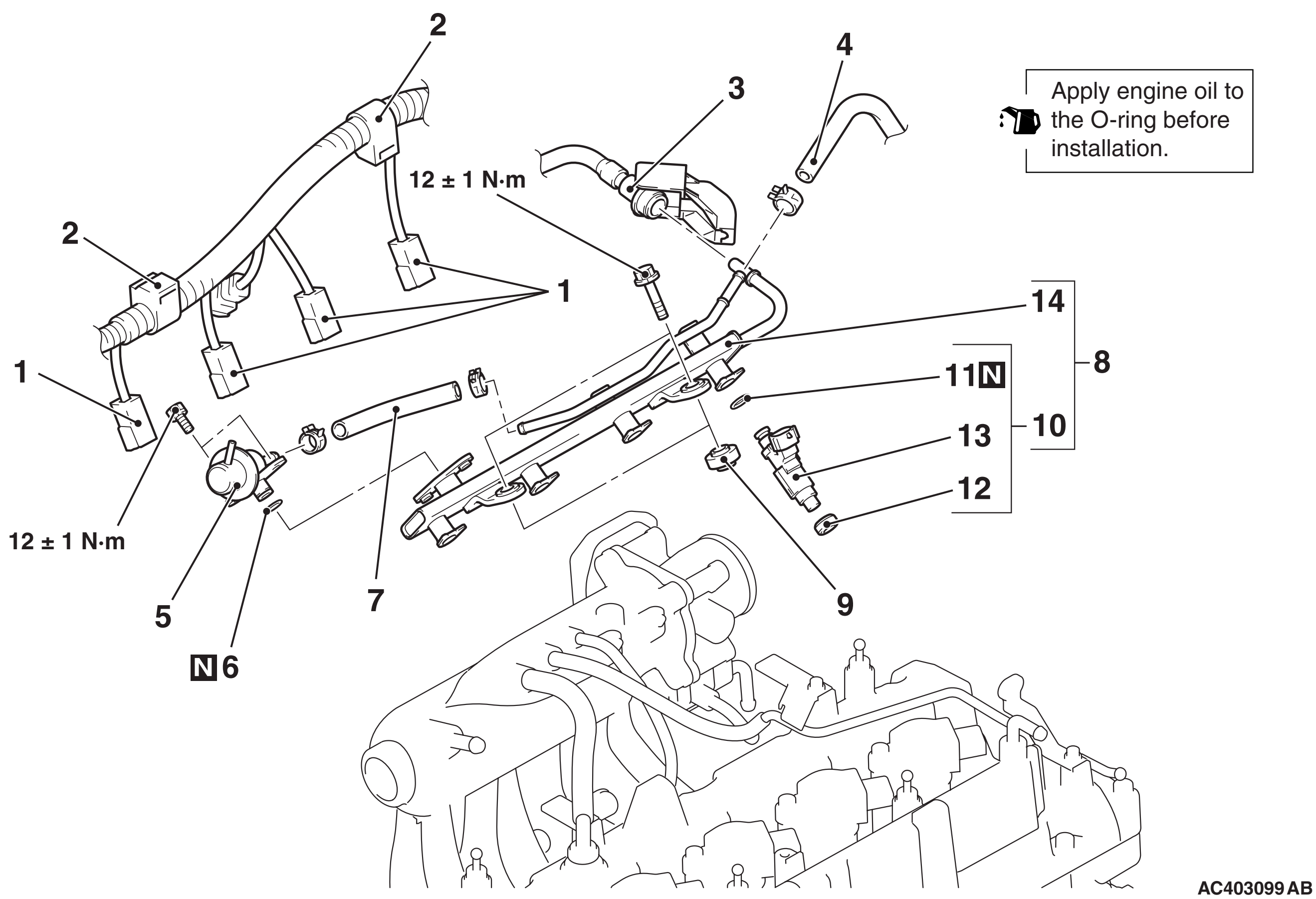
REMOVAL AND INSTALLATION

M1131007101772

⚠ CAUTION

When the fuel injector replacement is performed, use the M.U.T.-III to initialise the learning value (Refer to GROUP 00, Precautions Before Service – Initialisation Procedure for Learning Value in MPI Engine P.00-20).

Pre-removal Operation	**Post-installation Operation**
• Fuel Discharge Prevention (Refer to P.13B-360). • Engine Cover Removal (Refer to GROUP 11C, Camshaft and Valve Stem Seal P.11C-20). • Air Cleaner Assembly Removal (Refer to GROUP 15, Air Cleaner P.15-6). • Air Pipe B Removal (Refer to GROUP 15, Intercooler P.15-8).	• Air Pipe B Installation (Refer to GROUP 15, Intercooler P.15-8). • Air Cleaner Assembly Installation (Refer to GROUP 15, Air Cleaner P.15-6). • Fuel Leakage Inspection • Engine Cover Installation (Refer to GROUP 11C, Camshaft and Valve Stem Seal P.11C-20).



Removal steps

1. Fuel injector connector
2. Control harness clamp connection
3. <<A>> >>C<< Fuel high-pressure hose connection
4. Fuel return hose connection
5. >>A<< Fuel pressure regulator
6. O-ring
7. Fuel hose

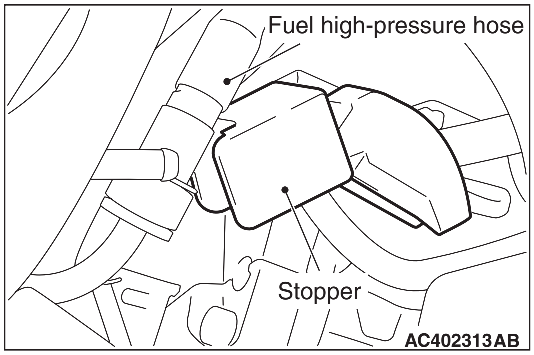
Removal steps (Continued)

8. <<B>> >>B<< Fuel delivery pipe and fuel injector assembly
9. Fuel delivery pipe insulator
10. >>A<< Fuel injector assembly
11. O-ring
12. Fuel injector insulator
13. Fuel injector
14. Fuel delivery pipe

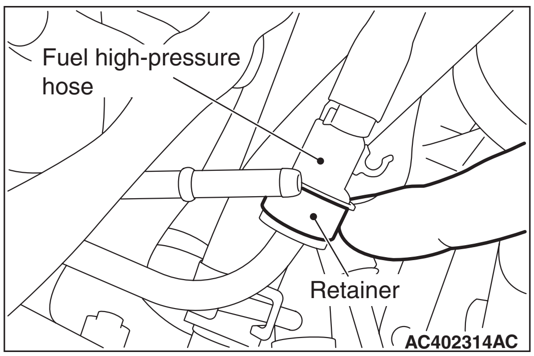
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REMOVAL SERVICE POINTS

<<A>> FUEL HIGH-PRESSURE HOSE DISCONNECTION



1. Remove the stopper.



2. Raise the retainer, and pull out the fuel high-pressure hose.

   NOTE: If the retainer comes off, install it securely after pulling out the fuel high-pressure hose.

<<B>> FUEL DELIVERY PIPE AND FUEL INJECTOR ASSEMBLY REMOVAL

⚠ CAUTION

Do not drop the fuel injector.

Remove the fuel delivery pipe with the fuel injector assembly attached to it.

INSTALLATION SERVICE POINTS

>>A<< FUEL INJECTOR ASSEMBLY/FUEL PRESSURE REGULATOR INSTALLATION

⚠ CAUTION

Do not let the engine oil get into the fuel delivery pipe will be damaged.

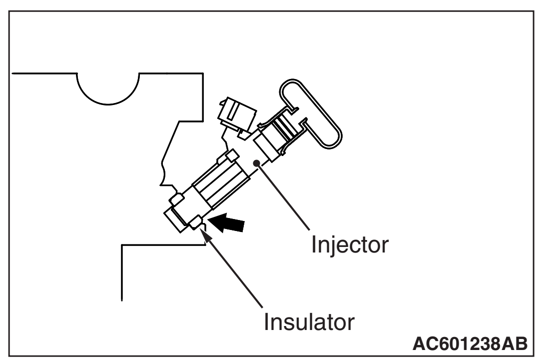
1. Apply a drop of new engine oil to the O-ring.
2. Turn the fuel injector assembly and fuel pressure regulator to the right and left to install to the fuel delivery pipe. Be careful not to damage the O-ring. After installing, check that the item turns smoothly.
3. If it dose not turn smoothly, the O-ring may be trapped, remove the item, re-install it into the fuel delivery pipe and check again.
4. Tighten the fuel pressure regulator to the specified torque.

   Tightening torque: 12 ± 1 N·m

>>B<< FUEL DELIVERY PIPE AND FUEL INJECTOR ASSEMBLY INSTALLATION

⚠ CAUTION

Securely bring the insulator into contact with the injector to prevent air leak from the insulator area.

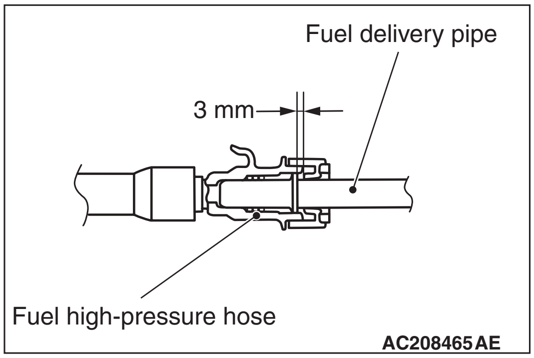


Be sure that there is no clearance between the insulator area and the injector, and install them to the cylinder head.

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>>C<< FUEL HIGH-PRESSURE HOSE CONNECTION

⚠ CAUTION



- **After connecting the fuel high-pressure hose, check that it has been securely installed by slightly pulling in the removal direction. At this time, also check that there is approximately 3-mm play.**
- **Do not let the engine oil get into the fuel delivery pipe will be damaged.**

Apply a small amount of new engine oil to the fuel delivery pipe, and install the fuel high-pressure hose to the fuel delivery pipe.

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THROTTLE BODY ASSEMBLY

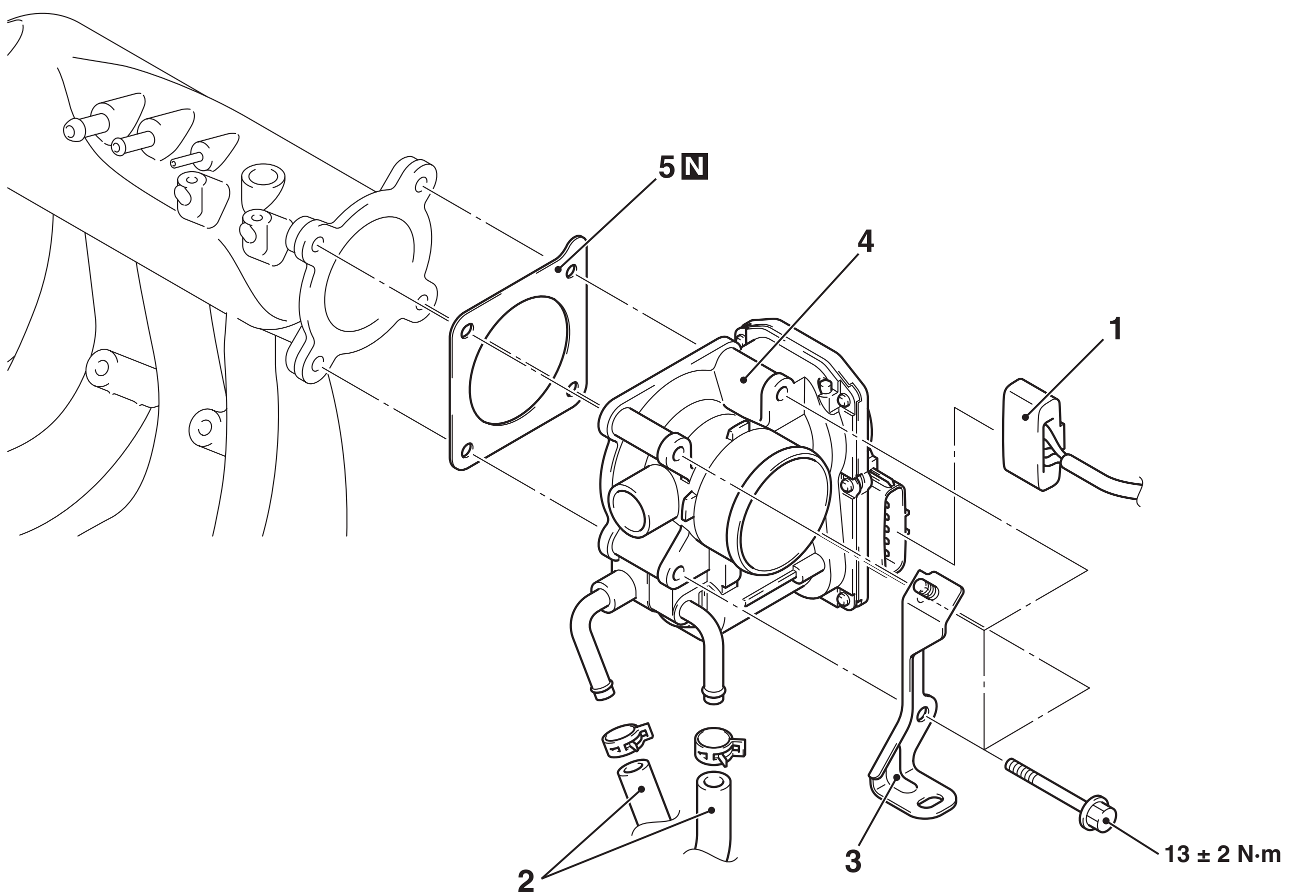
REMOVAL AND INSTALLATION

M1131007701451

⚠ CAUTION

- **When the throttle body assembly replacement is performed, use the M.U.T.-III to initialize the learning value (Refer to GROUP 00, Precautions Before Service – Initialization Procedure for Learning Value in MPI Engine P.00-20).**
- **Do not loosen the fixing screws for the resin cover of throttle body assembly. If the screws are loosened, the sensor incorporated in the resin cover becomes misaligned and the throttle body can not work normally.**

Pre-removal Operation	Post-installation Operation
• Engine Cover Removal (Refer to GROUP 11C, Camshaft and Valve Stem Seal P.11C-20). • Engine Coolant Draining (Refer to GROUP 14, On-vehicle Service – Engine Coolant Replacement P.14-6). • Air Cleaner Assembly Removal (Refer to GROUP 15, Air Cleaner P.15-6). • Air Hose D and Air Pipe B Removal (Refer to GROUP 15, Intercooler P.15-8).	• Air Pipe B and Air Hose D Installation (Refer to GROUP 15, Intercooler P.15-8). • Air Cleaner Assembly Installation (Refer to GROUP 15, Air Cleaner P.15-6). • Engine Coolant Supplying (Refer to GROUP 14, On-vehicle Service – Engine Coolant Replacement P.14-6). • Engine Cover Installation (Refer to GROUP 11C, Camshaft and Valve Stem Seal P.11C-20).



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Removal steps

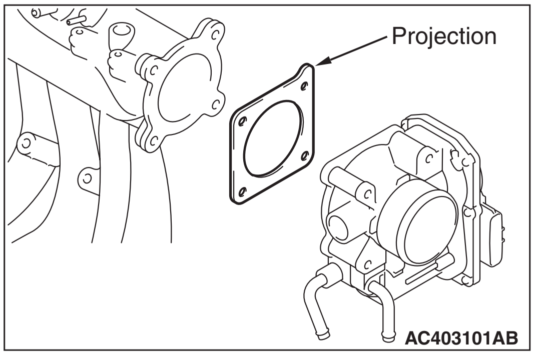
- >>B<< • Initialisation (Installation only)
- 1. Electronic control throttle valve connector
- 2. Throttle body water hose connection
- 3. Harness bracket

Removal steps (Continued)

- 4. Throttle body assembly
- >>A<< 5. Throttle body gasket

INSTALLATION SERVICE POINTS

>>A<< THROTTLE BODY GASKET INSTALLATION



Install the throttle body gasket as its protrusion is in the direction shown.

>>B<< INITIALISATION

When the throttle body is installed, removed or replaced, initialise the electronic-controlled throttle valve system according to the procedure below beforehand.

Turn the ignition switch from "ON" position to "LOCK" (OFF) position, and then hold "LOCK" (OFF) position for approximately 10 seconds or more.

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ENGINE-ECU

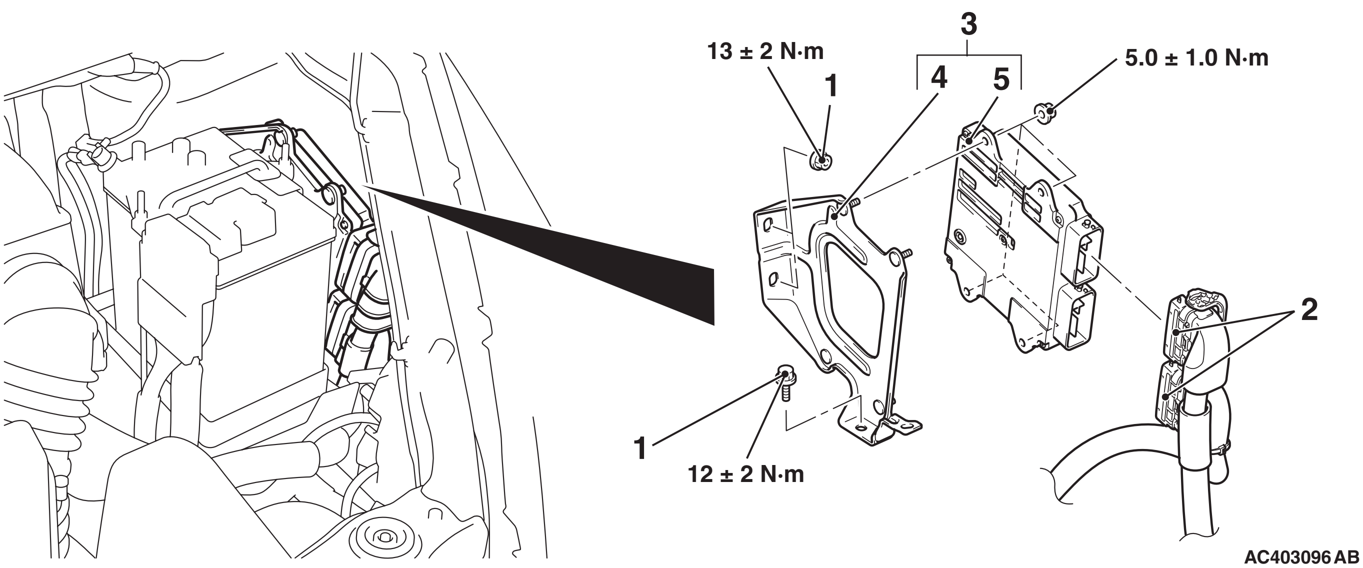
REMOVAL AND INSTALLATION

M1131033800393

⚠ CAUTION

- **When the engine-ECU replacement is performed, always refer to GROUP 54A, Ignition Switch − Encrypted Code Registration Criteria Table P.54A-8.**
- **After the engine-ECU is replaced, idling speed may be unstable because the MPI engine learning is not completed. To make it stable, make the system learn the idling (Refer to GROUP 00 − Precautions before Service, Learning Procedure for Idling in MPI Engine P.00-21).**

Pre-removal and Post-installation Operation
Battery Removal and Installation



Removal steps

- >>A<< • Initialization <Installation only>
1. Engine-ECU mounting bolt and nut
2. Engine-ECU connector
3. Engine-ECU and Engine-ECU bracket assembly
4. Engine-ECU bracket
5. Engine-ECU

INSTALLATION SERVICE POINT

>>A<< INITIALIZATION

When the engine-ECU is removed, initialize the electronic-controlled throttle valve system according to the following procedure after installing the ECU.

Turn the ignition switch from "ON" position to "LOCK" (OFF) position, and then hold "LOCK" (OFF) position for approximately 10 seconds or more.